

BYTE News . . .

32 Bit Microprocessors Are Rumored. While Zilog and Motorola are struggling to get their 16 bit microprocessor-ICs into production, Texas Instruments and Intel have been delivering theirs for some time. Now rumors abound that both TI and Intel will show prototype 32 bit processors by the end of the year and may be in production by the end of 1980 or the beginning of 1981.

Tremendous Growth of Personal Computer Systems Predicted for 1979. Mike Shea, marketing director for Atari, who recently brought two personal computer systems to the market, predicts a four to sixfold increase in personal computer sales for this year. He feels that between 200,000 and 300,000 personal computer systems will be sold this year, compared to 50,000 last year, and said that in the future Atari will pay less attention to developing new game consoles and instead concentrate on bringing out new software for existing units.

Fairchild Camera & Instruments predicts that 4.6 million programmable video games will be sold this year, worldwide, compared to 2.1 million in 1978. Further, they predict that 18 million cartridges, worth \$110 million, will be sold, compared to 5.7 million, worth \$18 million, last year.

Nonvideo games growth should prove even more dynamic, according to industry pundits. Sales should reach \$290 million in 1979, and possibly \$500 million in 1980.

Lear Siegler Shipped 40,000 Video Terminals in 1978. The Data Products division of Lear Siegler announced that in 1978 they shipped 40,000 video display terminals. This was more than they shipped in their six previous years of doing business. LS is predicting an increase in video display sales in 1979 of 25 to 30 percent.

Centronix Reports 20 Percent of Its Printers Go to Personal Computer Makers. Centronix, the leading maker of dot matrix printers, predicts that about 20 percent of its 1979 business will be from Tandy (Radio Shack TRS-80) and from Apple Inc. At the beginning of the year they were shipping 1700 printers per month to Tandy (in other words, 20,400 per year). Centronix is getting set to introduce a high density dot matrix printer and a word processing impact printer to compete with Diablo and Queme.

Computer Stores Becoming Big Business. Computer stores are becoming mass merchandisers, judging by an order recently placed with Perkin-Elmer Corp. Their terminal division announced that Micro-Age, a chain of five computer stores in Arizona and Texas, placed an order with them for 2000 of their new Bantam video display terminals. That's a far cry from the garage-type computer store operations of just a year or two ago.

Battle Shaping Up in 32K EROM. In February 1978 Texas Instruments introduced its TMS 2532 4K by 8 EROM (erasable read only memory), with full production promised for April or May. This meant that they were well ahead of all the other integrated circuit manufacturers. They accepted orders for the device at \$54 in 100 price lots. Intel introduced their 2732 erasable read only memory in November. Needless to say, the pinouts were different and a heated debate developed in the JEDEC committee over which would be the standard. TI hoped their 10 month lead would favor them. However, they encountered production problems and only started to deliver samples by year-end. Intel, in the meantime, is in production and has already lined up at least one second source. TI is promising production quantities by April. The unit price on the Intel part is currently \$140. The 2732 also uses the same pinout as the 2716 and 2708 EROMs.

HP May Be Developing Personal Computer System. Hewlett-Packard is rumored to be developing a new personal computer system at its Corvallis Oregon Consumer Products division. HP has been selling a desktop computer with BASIC in read only memory and an IEEE-488 interface for a few years now. It is expected that the system will be a scaled down version of this system, that it will have a base price of \$1000, and that it will be on the market this fall.

Tandy Developing New Computer. Tandy is rumored to be in development of a second generation Radio Shack TRS-80, possibly with color capability. Tandy, which has a 200,000 square foot plant and staff of 700 making the TRS-80, is supposedly looking for an outside manufacturer of the new system. Tandy also plans to develop many new software packages for introduction this year.

Magnavox Files Suit on Microprocessor Video Game Patents. Magnavox, the originator of video games played on home TV receivers, has filed suit against several manufacturers of programmable TV video games; among them

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THE S-100 BUS - WHAT IS ITS FUTURE?: Some industry pundits have speculated that the S-100 bus was doomed when integrated machines like the TRS-80, PET, Apple, et al, were introduced. I do not agree with this view.

There are now an estimated 200,000 S-100 systems in operation, and S-100 system sales should continue strong for a number of reasons.

The S-100 bus is not processor dependent. In fact there are presently 8080, Z80, 8085, 6502, 6800, 6809, 9900, 8086, Z8000 and MCP1600 processor boards that plug into the S-100 bus. The 68000, when it becomes available, will surely be adapted for the S-100 bus also.

It allows for extended addressing beyond 64 K bytes of memory. In fact the 16-bit microprocessors on the S-100 bus employ up to 23-bit address words and can access directly up to 2 M bytes of memory. The 8-bit microprocessors can accomplish a similar feat by a bank-switching arrangement. The Institute of Electronic and Electrical Engineers (IEEE) is adopting an S-100 standard, which should eliminate signal and timing problems and encourage sophisticated 16-bit systems.

The S-100 bus has a lot of other goodies such as vectored interrupt, direct memory access (DMA), and master/slave capabilities, which are not possible on the limited bus structures of machines such as the TRS-80, PET, APPLE, etc.

At least 3 new S-100 mainframes have been introduced so far this year. These newer boxes are capable of operating at speeds up to 10 M Hz, have larger power supplies and other features.

Those who wish to have a machine capable of getting the maximum benefits of microprocessors must go the S-100 route. The S-100 bus will thus continue to dominate the serious personal computing area for many years to come.

NEW IMAGE SENSOR USES PHOTODIODE ARRAY: An integrated circuit consisting of a 64 by 64 array of 4096 photodiodes with associated registers and accessing circuitry has been developed for video camera use. The manufacturer, Integrated Photomatrix Inc, Mountainside NJ, claims that it can produce video-quality gray scale images with illumination as low as 60 foot candles. This is 5 to 8 times more sensitive than previous devices. However, the most important feature is that it lends itself to computer processing.

RANDOM NEWS: Atari has received FCC approval for their model 400 and 800 personal computers. This will probably make the FCC less willing to grant the Texas Instruments request for changes in the rules, as the FCC finds that other companies are able to pass current requirements . . . Radio Shack will open 100 Computer Sales Departments in 100 existing stores, in addition to the 50 Radio Shack Computer Centers already in operation . . . Two pioneer personal computer companies have shut their doors and are out of business. They are Processor Technology Company and Xitan Inc (formerly TDL). Their closings are attributed to poor business management, not lack of business.

RANDOM RUMORS: Shugart is about to announce an 8 inch Winchester disk drive for under \$1000. Rumor is that it will be called the Model SA-1000 and will store 5 M bytes. In original equipment manufacturer (OEM) quantities it may sell for as little as \$750 . . . 5¼ inch Winchester-type drives are being investigated by several manufacturers . . . Digital Equipment Corporation's Computer Stores are proving to be a real success. Four stores are already in operation and 6 more are planned to be opened by the year's end. The stores will sell computers in the \$12,000 to \$18,000 range with supplies and accessories aimed at small business users . . . A record 78,843 people attended the National Computer Conference (NCC) held in New York City this past June. This was 22,000 more than last year, which also set a record . . . Sinclair Radionics Ltd, London, England, has demonstrated a flat screen (3 inch) black and white television receiver, the size of a paperback book. They are now looking for financing for the production of the unit. This may be the forerunner of the pocket computer terminal.

PERSONAL COMPUTER TIMESHARE NETWORK INAUGURATED: Telecomputing Corporation of America, McLean Va, has started a Personal Computer Network which may be accessed by home users with terminals or personal computer systems. They have about 2000 programs and data bases on-line for immediate access. Included is the United Press International (UPI) daily news file, airline schedules and real estate listings. Called "The Source", the service will be available in 200 US cities at \$2.75 per hour from 6 PM to 7 AM, weekends and holidays. The rate during normal working hours will be higher.

LOOK IT UP IN THE DATA DICTIONARY: Data base management (DBM) systems are growing in size, sophistication, and popularity. Users, therefore, need more advanced tools for defining and keeping track of their data resources. Data dictionaries have been developed to do this and to augment existing data base management systems. The data dictionary is integrated into the data base management system's nucleus and utilities as well as managing the data resources.

On large computer systems such as the large IBM mainframes, the problem of managing these systems is acute, and data dictionaries are popular here. However, data dictionaries are now being developed for minicomputer systems as they increase in complexity. Someday you can expect to see them on microcomputer systems.

IEEE-488 BUS INTERFACING SIMPLIFIED: Now you can interface your computer system to the IEEE-488 bus without a special bus interface. ICS Electronics Corp, San Jose, California, has come up with an easy way of doing it. They have developed a 488-to-RS-232C interface and controller. Just place this device in the line between your terminal and processor and plug your IEEE-488 cable into the device. Now you can program your computer to process data coming from all those instruments with 488 interfaces.

SILICON VALLEY-II DEVELOPING: "Silicon Valley" is the nickname given to the area in California just south of San Francisco that has the highest concentration of integrated circuit manufacturers. A regional shift now appears underway as more and more integrated circuit manufacturers are opening facilities in Texas. Long the stronghold of Texas Instruments, the Dallas and Austin areas have seen the opening of plants by Mostek and Hitachi. Now, Motorola and Advanced Micro Devices are following suit. The desertion of California appears to be due to high operating costs.

GTE TAKES ON VIEWDATA: General Telephone and Electronics Corp has been licensed to offer Viewdata information services in the USA and Canada. Viewdata was developed by the British Post Office, and is a data base information system allowing users to access data on their television receivers via telephone lines.

DUAL-SIDED FLOPPIES STILL IN SHORT SUPPLY: Shugart expects to finally get into quantity production on dual-sided floppy disks by the end of the first quarter of 1980. Presently they are shipping only limited quantities. Originally introduced in early 1977, Shugart did not start shipping until early 1979. Media wear problems caused these delays and has limited production to 100 drives per day at best. Shugart has designed a completely new double-sided head which they expect will cure these problems. However, Shugart has found it necessary to increase the price of the drives. The SA850, an 8-inch drive, in 500-lot quantities will be priced from \$485 to \$580.

FCC COMPLETES RADIO FREQUENCY RADIATION TESTS: The FCC has completed its test of six personal computer systems and will release its data soon. Reportedly, the FCC has found that all but one exceed the interference levels permitted for devices that connect to television receivers (eg, games). The test included the Atari, Apple, PET, Heath, Southwest Technical Products, and Radio Shack systems. Only the Atari system passed. The rest caused excessive radio frequency (RF) radiation interference on nearby television receivers. None of these systems are required to meet the existing regulations. In the meantime, the large numbers of personal computer systems in use are beginning to generate interference complaints.

8080 STILL GOING STRONG: The 8080 microprocessor, introduced by Intel in 1974 and the integrated circuit that started the microprocessor "revolution," is still going great. This is despite improved successors such as the Z80 and 8085. An estimated 500,000 8080As are being made each month, and many purchasers are finding them in short supply. The 8080A is currently being made by five manufacturers. Prices for large quantities have gone back up to the \$3 to 4 range, after they had dipped as low as \$2.75 each in late 1978. Demand for the 8080A is expected to continue strong through mid-1980, and it should continue in production for several more years.

MAIL: I receive a large number of letters each month as a result of this column. If you write to me and wish a response, please include a stamped self-addressed envelope.

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INTEL 32-BIT MICROPROCESSOR RUMORED: As reported in this column last April, Intel was rumored to be working on a 32-bit microprocessor. The project is moving closer to reality as Intel has assigned a part number to the device. It will be called the 8800 (not to be confused with the Altair 8800 computer). The instruction set will not be compatible with Intel's 8-bit or 16-bit microprocessors. The device will be housed in the new 64-pin QUIP (quad-in-line package, see "BYTE News," June 1979) which is cheaper, smaller, and easier to test than dual-in-line packages. The 8800 is reportedly being developed at Intel's facility in Aloha OR. The first test prototypes are reported to have been produced.

TI RF MODULATOR FCC WAIVER GRANTED: The Federal Communications Commission (FCC) has granted Texas Instruments a waiver which permits TI to connect its personal computers to home color television receivers using a radio frequency (RF) modulator. TI originally petitioned the FCC for approval of the RF modulator system in February 1979. The petition was rejected since the regulations required that the complete system be submitted for approval: TI submitted only the RF modulator for approval. Subsequently, Texas Instruments applied for a waiver, provided that the modulator unit met the standards.

The FCC asked other personal computer system manufacturers to comment on the TI request. Radio Shack, Apple Computer, Commodore, Mattel, and Atari responded negatively to the request. Apple, Atari, and Mattel went to great expense to comply with the FCC regulations. The Radio Shack and Commodore systems, which contain integral displays and do not use RF modulators, do not come under the FCC regulations.

The FCC decision further waives testing by the FCC and merely requires that the manufacturer provide the FCC with test results showing compliance. In a related action, the FCC relaxed the standards on RF interference generated by commercial and personal computer systems.

Several personal computer manufacturers that compete with TI have already stated that this waiver will give TI a competitive advantage. Furthermore, several firms publicly questioned the FCC's rule-making methods in making its decision. The likelihood now is that the other personal computer makers will offer systems with RF modulators. It will probably take these manufacturers at least a year to bring out such competing systems.

ULTRA MINI-FLOPPY DRIVE INTRODUCED: Sanyo Seiki Manufacturing Co, Tokyo, Japan, has begun producing samples of an ultra-small floppy disk drive and controller. Called the FMC-100, it uses a 2-inch floppy disk that stores 8 K bytes on one track. It is intended for use in word-processing typewriters and personal computer systems.

THWARTING COMPUTER SOFTWARE PIRATING: A patent (number 4,168,396) has been issued to Robert M Best, Seattle WA, for a "microprocessor which prevents the piracy of computer programs." The device reportedly uses cryptography to protect the software. It is called a *crypto-microprocessor* and stores software in cipher to prevent it from being copied, disassembled, or altered by unauthorized processes. Authorized users can decipher the software with special encryption keys. The patent states that the device is intended primarily for use in personal computer systems.

AC LINE TO TTL INTERFACE IC INTRODUCED: General Instrument Optoelectronics of Palo Alto CA has introduced a low-cost, 8-pin integrated circuit that can be used to directly monitor AC power line circuits and provide transistor-transistor logic (TTL) outputs. The device, therefore, can be used to interface your microprocessor inputs easily and directly to monitor AC power-line-operated devices such as motors, solenoids, relay contacts, and the like. It can also be used to detect power failure and other such applications.

FLAT PANEL TERMINAL DISPLAYS BECOMING AVAILABLE: Computer terminals using flat-screen video displays are getting close to the marketplace. The technology is based on the plasma panel developed by Owens-Illinois, Toledo OH, in the late 1960s. Currently, Interstate Electronics of Anaheim CA, IBM, and Fujitsu have these panels in production. Control Data and NCR are planning large-scale production. IBM now makes approximately 100,000 plasma panels annually, which

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VOICE-CONTROLLED CONSUMER PRODUCTS: At a recent electronics show in Japan, several Japanese manufacturers demonstrated voice-response and voice-activation of many consumer products. Sanyo, Toshiba, Sharp, Sony, Hitachi, and Matsushita demonstrated a wide variety of consumer products that respond to oral commands. Using microprocessor-controlled speech analyzers and synthesizers, the processors controlled television channel selection, volume and color control, and operated video games and clocks. Some units talked back to confirm user commands.

It is expected that many of these products will be commercially available in a year or two. Present technology allows registration of up to three persons in the voice-recognition circuit. Manufacturers agree that the voice recognition is not 100% perfect, but that it will be in time.

SOME HOME COMPUTERS FAIL FCC RFI SPECS: The Federal Communications Commission (FCC) has released the results of their tests of personal computer systems for radio-frequency interference (RFI). RFI has become an increasing problem to television and FM radio reception, similar to the citizen's band radio interference problem several years ago. The FCC has proposed as a standard a radiation limit of 100 microvolts per meter at a 3-meter distance.

Early last year the FCC tested the Radio Shack, Apple, Heath, Texas Instruments (TI), Commodore PET, and Southwest Technical Products personal computers. Only the Texas Instruments and Commodore systems met the specification. Atari had submitted and passed the specification earlier.

The standard goes into effect July 1, 1980, and all manufacturers have declared their intention to make necessary modifications to assure compliance with the specifications.

CENTRONICS REVEALS NEW PRINTING METHOD: In a press conference held on November 13, 1979, Centronics Data Corp of Hudson, New Hampshire, demonstrated a new method of printing on paper. A single stylus driven by voice coils through a parallelogram flexure mechanism presses a carbon ribbon against paper to form characters in almost the same way as people write using pens and pencils. Character fonts are switched by changing the controlling software; an almost infinite variety of symbols may be produced, including mathematical, Greek, Chinese, Cyrillic, and Arabic character sets. The prototype Quietwriter typewriter devices print with excellent quality at a speed of 17 cps for English-language character sets. Products using the Quietwriter mechanism may be sold beginning about the third quarter of 1981.

NEW LISP SYSTEM: The LISP Co (T.(L.C)) of Los Gatos, California, has completed their first version of LISP for the Z80. It is a dialect of the MIT LISP-Machine LISP, complete with strings, I/O streams, Muddle's parameter-description mechanism, and comprehensive documentation. This version was done for a major personal computer manufacturer; (T.(L.C)) will soon announce their own version that will include hardware to support the LISP programming environment.

HOBBYIST ELECTRONIC MAIL SYSTEM FORMING: Hobbyists are setting up a low-cost mail system using their microcomputers. This is possible using a \$12 software package from the Personal Computer Network (PCNET) committee. With it, a personal computer owner can set up his machine to automatically dial another system or systems at a preset time (usually late at night), deliver messages, and return a status report (delivered or not delivered).

Hobbyists are also setting up dial-in, free-access message systems for discussion purposes using the FORUM-80 software and Radio Shack TRS-80s. Three forums are already in operation: forums devoted to tracing family histories (in Fairfax, Virginia), information on engineering applications of microcomputers (Olathe, Kansas), and applications of microcomputers for the handicapped (Memphis, Tennessee). For more information on these applications, contact Jon Tara, c/o SEMCO, POB 9578, Detroit MI 48202.

COMPUTER COMPANIES GO INTO RETAILING: The latest computer stores are those set up by Digital Equipment Corp (DEC), IBM, and NCR. Following the innovative experiences in computer retailing established by Tandy Corp and independent stores, the traditional computer manufacturers have decided to meet the challenge head on. DEC already has in operation almost twenty "computer stores" where customers can sample the DEC small computers. However, the stores have no inventory and purchases are shipped from a distribution center.

IBM now stocks their 5110 small business systems at fifty centers where a purchaser can get a system on a cash-and-carry basis. These centers were originally opened to demonstrate and train users, and then the retail operation was added. A typical system sells for \$16,000.

NCR has opened two pilot stores in Cincinnati to sell cash registers and small computers in the \$15,000 price range. Data General is selling its MicroNOVA system through fifty independent dealers, and Texas Instruments is beginning computer demonstrations in its San Francisco store.

With the cost of small business computer systems decreasing, the profit margin is no longer enough to support the high-cost selling techniques of large computer systems.

MOTOROLA, TANDY AND WESTERN UNION INTRODUCE "GREEN THUMB" SYSTEMS: Sponsored by a grant from the US Department of Agriculture, Motorola and Western Union will set up an experimental agricultural video-telephone information system known as Project Green Thumb. Tandy Corp will manufacture the terminals to be located in 200 farm homes in Kentucky. Farmers, via telephone lines, will be able to access weather, market, and agriculture data from remote computers.

RANDOM NEWS: Atari has filed an appeal with the Federal Communications Commission (FCC) to stay the decision (reported in last month's BYTE News) in which the FCC granted Texas Instruments a waiver on permissible interference standards for personal computers. Atari feels that if other companies can pass the specification, then the TI request should not have been granted . . . Texas Instruments will soon have competition in the voice synthesis area. National Semiconductor Corp and ITT Semiconductor are both showing samples of their new synthesizer parts. These integrated circuits are aimed at low-price consumer applications such as talking clocks, telephone-answering equipment and automobile warning devices . . . Texas Instruments has introduced four new terminals that have dual-matrix print heads. The head prints two characters with each pass across the page enabling the unit to print 120 characters per second . . . MIT (Massachusetts Institute of Technology) has received a development contract worth several million dollars from Heath Co and Exxon Enterprises. The contract calls for the MIT Computer Science Laboratory to develop an advanced cartridge-disk-based 16-bit microcomputer system for use in office automation. Although initial plans called for MIT to use Zilog's 16-bit microprocessor, it is reported that they have switched to the Motorola 68000 to use memory more efficiently. Both Heath and Exxon will have nonexclusive manufacturing rights, and Exxon will have exclusive software rights . . . Chuck Peddle, the developer of the 6502 microprocessor, the KIM-1, and PET computers, has a new product. It is the Commodore 4500 4-bit microprocessor. It represents a radical departure from the 6502 architecture . . . Researchers at Bell Labs announced the development of an improved electrochromic display using iridium. It consumes less power and could be cheaper to produce than light-emitting diode and liquid-crystal type displays. It does not have to be energized continuously and is pulsed to turn on and off.

APOLOGY DUE: In the September 1979 BYTE News column, I reported on 16-bit 8086 processor boards for S-100 systems. I regret that I omitted mention of a company that has been making such a board since December 1978. The company is Tecmar Inc, 23414 Greenlawn Ave, Cleveland OH 44122. They sell a complete line of S-100 boards to make up a complete system.

RANDOM RUMORS: Apple Computer will soon introduce the Apple III, and it is rumored that it will not use the 6502 microprocessor. Apple is keeping a tight lid on their plans (bit-slice, perhaps?) for this unit. . . Digital Research, the firm that developed CP/M, the most popular disk operating system for microcomputer systems, will soon announce a version of CP/M for the Intel 8086 16-bit microprocessor, which will include an assembler program. . . IMI (International Memories Inc) of Cupertino, California, the first company to ship 8-inch, Winchester-technology, hard disk drives, is rumored to be planning to show a 5¼-inch, 3-megabyte Winchester drive at the 1980 National Computer Conference in June. Rumor is that there will be at least one other such drive shown at the NCC. . . .

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BYTE News . . .

FRANCE TO INTRODUCE HOME TERMINALS: The French Postal and Telecommunications agency is undertaking a project to put a computer terminal in every home. According to a report that appeared in *Business Week* magazine, the government agency intends to give all telephone customers a free two-way video display terminal, in lieu of printed directories. A similar machine that can send and receive a full page of text in two minutes will also be offered for under \$500. Over 1000 terminals will be installed early next year. Each terminal is expected to cost the agency less than \$100.

IBM MOVES TO ASCII: Until now you either did it the ASCII way or the IBM way. In other words, all IBM communication was done in Extended Binary-Coded-Decimal Interchange Code (EBCDIC), while all other computer manufacturers used the American Standard Code for Information Interchange (ASCII). Anyone who has tried to interface an IBM terminal to a non-IBM system has encountered the problem.

Now IBM has introduced their first product that uses ASCII, the model 3101 video terminal. Depending on options, prices range from \$1300 to \$1520. These units can be ordered over the telephone, and IBM installation is not required, as is the case with all other IBM products. The unit, largely made in Japan, qualifies for discounts up to 20%—a new departure for IBM.

IBM has apparently been forced to compete with other computer component makers on their level. This may be the forerunner of a new IBM marketing philosophy for small-computer systems.

Rumor has it that IBM will become more aggressive in the small-computer market with enhancements to its 5110 tabletop computers. Look for IBM to increase the number of "retail stores" for small-business computer systems to 200 by the end of 1980. Most of these stores will be in branch offices of the General Systems Division.

TANDY, APPLE AND ATARI ASK FCC FOR DELAY: Atari asked the Federal Communications Commission (FCC) to delay the effective date of the waiver of rules for Texas Instruments (as previously reported in the January 1980 *BYTE News*) until a rulemaking proceeding on television-interface devices is completed. Atari cited allegedly illegal action by the FCC in granting the waiver and noted the potential increased radio and television interference. After two weeks consideration, the FCC rejected Atari's request.

Tandy Corporation and Apple Computer Company asked the FCC to delay the deadline for compliance with the FCC's new radio frequency interference (RFI) standard, which is due to go into effect on July 1, 1980. Both firms have claimed that this is too short a time to change manufacturing processes and order the necessary components.

LATEST RUMORS: Designers of Radio Shack's successor to the TRS-80 Model I have changed their minds and will employ Microsoft for writing the BASIC interpreter and operating system. Motorola also made a bid to do this software development; however, Microsoft ended up with the contract. Radio Shack had been planning to call the unit the "TRS-90," but the firm is now leaning toward "TRS-80/COLOR." . . . It is rumored that Sony and Texas Instruments have reached an agreement whereby Sony will sell Texas Instruments' personal-computer systems in the United States under the Sony name, with a Sony Trinitron color video monitor, instead of the Zenith monitor Texas Instruments is currently using. . . . Microtype Corporation will soon introduce a \$250 electronic typewriter with RS-232 input/output (I/O). It will use a daisy-wheel-like printing method, and it will print 15 characters per second. Look for it by the end of 1980. . . .

RANDOM NEWS BITS: Burroughs has introduced a 6 megabyte floppy-disk drive. It holds two disks on a common spindle and uses four data-transfer heads on a common assembly. Cost is only \$1950 in original equipment manufacturers quantities. . . . GR Electronics Ltd of Santa Monica, California, has introduced a pocket ASCII terminal in a case the size of a standard pocket calculator. It has forty keys and transmits the 128 ASCII character codes. It has an light-emitting diode display and stores thirty received characters. It has an RS-232C interface (110 or 300 bits per second), requires 5 V at 400 mA for power, and sells for \$395. . . . Hewlett-Packard (HP) has introduced its personal-computer system. The system costs \$3250 and is being manufactured at HP's Corvallis, Oregon, calculator division. See page 60 in this issue for a report. . . . Godbout Electronics, Oakland Airport, California, plans to introduce an S-100 processor circuit card that contains both 8088 and 8085 microprocessors on the same card. The 8088 is a 16-bit processor with 8-bit I/O (it executes 8086 ob-

ject code). A user can run the standard CP/M operating system on the 8085 to handle all I/O devices, and use the 8088 to run software such as a multi-user BASIC system. The processor card will drive 24 address lines (16 megabytes of memory space), and has a direct-memory-access (DMA) peripheral controller. . . .Heath Company has decided to resume production of the H8 8080-based microcomputer system. Surprisingly, the sales of the H8 have increased, despite the introduction of the Heath/Zenith H89 integrated Z80-based system. Apparently, with its plug-in bus construction, the H8 is more to the liking of hobbyists who prefer to configure their own systems. Also, Zenith is now producing the assembled Heath H19 video terminals on one of its television set production lines. . . .Mattel Electronics and General Instrument are about to start testing a television attachment that can receive a variety of video games sent over cable television. . . .McGraw-Hill, *The New York Times*, *Times-Mirror*, and *Time Magazine* are considering setting up systems which would allow personal-computer users to access their data bases.

HIGH-DENSITY 5-INCH DISK DRIVES: Micropolis Corporation and several other floppy-disk drive makers have announced 5-inch floppy-disk drives with a density of 96 tracks per inch (tpi). Forty-eight tracks per inch has been standard, while some firms have sold 77 tpi drives.

The Micropolis disk system will read older 48 tpi disks by skipping every other track under software control. The new drives will range in capacity from 436 K to 1064 K unformatted bytes and will cost between \$450 to \$570 each.

PERSONAL COMPUTER SYSTEM DELIVERIES DELAYED: Texas Instruments (TI), Mattel Electronics, and Atari have all experienced delayed deliveries of their personal computer systems in the past few months. Delays were due to a shortage of parts, which restricted production of these new systems. Atari did not start shipping units until October 1979, and TI did not start until November. Quantities were severely limited during the Christmas season. Mattel did not even start shipping until after Christmas. In all cases, the companies claimed that "silicon shortages" caused the delays. TI and Atari had promised to start deliveries in August. This problem is common throughout the computer industry, due to an unexpectedly high demand for integrated circuits.

DATA-STORAGE ADVANCES PREDICTED: A San Jose, California, market research firm has released an interesting report on the future of microcomputer storage systems. Creative Strategies International predicts that during the next two years we will see the introduction of new, low-cost 5-inch and 8-inch Winchester-technology disks, new sizes (4-inch and 6-inch) of Winchester drives, "back-end" processors (disk controller and data base manager), and on-line archives in both video-disk and cartridge-tape form.

Low-cost, 5-inch floppy-disk drives and digital cassettes are expected from Japan. They will be mass-produced for intelligent-typewriter and home-computer applications. Prices of floppy-disk and Winchester disk drives are expected to drop to less than one-third of current prices.

The new small Winchester disk drives, or micro-Winchesters, will have storage capacities starting at 1 megabytes and removable disk modules about the size of an 8-track audio tape cartridge. The back-end processors will be available by the mid-1980s. They will combine Winchester-disk-controller and data-base-management functions in large-scale integrated circuits, with fast parallel architecture, content-addressed memory, charge-coupled memory systems or bubble memory. On the other hand, 8-inch floppy disks should reach the 5 megabyte capacity by the mid-1980s.

BUBBLE MEMORY STATUS REPORT: Bubble memory has developed considerably during the past year. Device size has jumped from 64 K bit, serial shift-register architectures to 1 megabit major/minor-loop, block-replicate architecture. Four megabit devices, organized as 4- and 8-bit words, are expected next year. Access times have dropped from hundreds of milliseconds; under 10 milliseconds is expected by the end of 1980. Five companies, Fujitsu, Intel, Plessey, Rockwell and Texas Instruments, are now competing for a share of the developing bubble memory business. Three more companies, Hitachi, Motorola, and Siemens, are expected to enter the market this year.

SPEECH-SYNTHESIS TECHNOLOGY IMPROVING: A year and a half ago when Texas Instruments introduced its Speak & Spell toy with voice output, the experts were amazed at its voice quality and low cost. Now single-board synthesizers, which can be easily interfaced to computers, are available from Texas Instruments, the Votrax Division of Federal Screw Works in Troy, Michigan, and Telesensory Systems Inc (TSI) of Palo Alto, California (TSI specializes in products for aiding the blind). Even IBM has added voice output to a typewriter. Further, Texas Instruments has now made available a low-cost voice synthesizer chip set for use by game and appliance manufacturers.

The Texas Instrument synthesizer stores words in its memory and thus is limited to 180 standard words, plus up to 180 words stored in external read-only memory. On the other hand, the Votrax unit is programmed with 62 phonemes (sound units) and can form an unlimited number of words.

BYTE News . . .

NEW DEVELOPMENTS FROM COMMODORE: At a recent private showing during the Winter Consumer Electronics Show in Las Vegas, Nevada, Commodore Business Machines revealed some impressive work in progress. Heading the list was the prototype of the TOI ("The Other Intellect") color computer. Aimed at the low-end market, the TOI is designed to interface with your home color television set. The displayed image will feature 16 colors, 160 by 192 resolution (with three colors in the high-resolution mode), Microsoft BASIC, and a standard keyboard. The price could be under \$700. Other devices included the Commodore CBM computer outfitted with a Shugart SA-200 5¼-inch floppy-disk drive (still under development). The SA-200 is a very low-cost drive that is less than 1 inch high, and employs an electromechanical track-to-track seeking mechanism for the head that is somewhat slower than conventional drive mechanisms. Commodore is also working on a Plato-like touch panel and a speech synthesizer (from Votrax). Also on hand was a prototype Memorex model 101 8-inch hard-disk drive and interface. Commodore stressed that all of these products were still under development, and that not all of them would necessarily get to the marketplace.

ATARI AND NAB TAKE FCC TO COURT: Atari Inc and the National Association of Broadcasters (NAB) have gone to the United States Court of Appeals asking that the Federal Communications Commission (FCC) review its recent decision allowing Texas Instruments Incorporated (TI) to sell its TI-900 stand-alone radio frequency (RF) modulator, which will allow a TI home computer to work with a standard color television set.

Late last year the FCC altered its rules (see BYTE News, January 1980) and granted TI a waiver. Atari asked the FCC to delay the effective date of the waiver until appropriate technical standards were developed. The FCC rejected Atari's request. Tandy Corporation and Apple Computer Company made similar requests. The requests claimed that the FCC decision allowed TI to circumvent the FCC's rulemaking.

The NAB is concerned with the interference that modulators cause on television and radio reception. The NAB is also challenging the FCC's radiation limits as being too high. This could cause interference, particularly in weak television signal areas. In addition to interference caused by personal computers, the NAB is concerned with interference from computer games and video recorders.

NEW HIGH-SPEED COMMUNICATIONS BUS: Xerox Corporation recently made a public announcement of a new concept of processor-to-processor communications intended for an office environment. This novel concept is called "Ethernet," and is a result of some of the work being done in their research labs. In this concept, a single coaxial cable is used as a high-speed communications bus between all processors; communication protocol is handled through software or software supplemented by special-purpose hardware. Rumor has it that an Ethernet processor is now being developed by some form of joint arrangement between Xerox and Intel.

NEW 16-BIT PROCESSOR CARDS TO BE INTRODUCED: Several manufacturers will soon introduce Z8000 and 68000 printed circuit cards for S-100 and SS-50 bus systems. Ithaca Intersystems Incorporated will shortly commence shipping its Z8000 processor card for S-100-based systems. They also have a 68000 prototype processor card running on the S-100 bus, but they do not plan to manufacture the card at this time. Gimix Incorporated does plan to manufacture a 68000 processor card for SS-50 bus systems. Gimix plans to use a multiplexed approach so that no reworking of the SS-50 mainframe will be required.

CAN DEPARTMENT STORES SELL PERSONAL COMPUTERS? The answer to this question from the stores, at this point, is a noncommittal "yes." Sears Roebuck and Montgomery Ward (MW) started test marketing personal computer systems last November. MW attempted selling several Ohio Scientific and Interact Electronics systems in a few selected stores. Although at the time of this writing not all results were in, the opinion was that the test, although not meeting with an enthusiastic response, developed sufficient sales to merit continued test marketing. Most system sales were to small businesses rather than consumers. The systems were being used for applications such as inventory control, word processing, and record keeping.

Sears Roebuck also was guarded in its appraisal of the test marketing of the Atari system through its Christmas catalog and selected stores. Although sales have not increased dramatically, they are sufficient for Sears to continue marketing tests.

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Editorial

Threads of a FORTH Tapestry

Editor's Note: *This month's editorial is by BYTE Editor Gregg Williams. Gregg was responsible for the preparation of this month's special section devoted to the FORTH language. Carl Helmers returns next month with an editorial....CM*

What do a portable heart monitor, the new Craig Language Translator, a peach-sorting machine, and a movie called *Battle Beyond the Stars* have in common? The answer is FORTH, a not-so-new language as comfortable in industrial machinery as it is in a personal computer. In fact, it was originally used by its inventor, Charles H Moore, to control the telescope and equipment at the Kitt Peak Observatory.

Although I have known about FORTH for about a year, it was only during the preparation of this issue that I began to actively keep my ears open for mention of this unusual language. I have uncovered a lot of information (and some experience) about FORTH and its variations. The language is so unusual that no single line of thought could give you a picture of what the language is like. Instead, the following sections represent several threads from the rich tapestry called FORTH.

FORTH in the Real World

No language I know of is as comfortable in real-world situations as FORTH. Here are some examples of the breadth of applications that have been created using FORTH:

- Elicon Inc of Brea, California, is using FORTH software to drive the same kind of computer-controlled cameras that were used to film the sophisticated space-battle scenes in *Star Wars*. New World Productions of Venice, California, is using this camera system to film the spaceship sequences in the motion picture *Battle Beyond the Stars*. In a related development, Magicam Inc (which devised a number of the special effects for the recent movie *Star Trek*) is in the process of converting control of its master-slave camera pair from an analog computer to a digital computer running FORTH software. In the Magicam process, the master camera follows actors on a special blue stage while the computer guides the slave camera across a detailed model. Later, the two images are optically combined, producing the effect of the actors actually being in the landscape depicted on the model.

- Allen Test Products of Kalamazoo, Michigan, has developed an ignition analyzer for use in service stations and automobile repair shops that analyzes the behavior of automobile ignition systems and displays both diagnostic and corrective information. Formerly, the voltage waveform from a spark plug was displayed on an oscilloscope, after which a mechanic would attempt repairs based on his interpretation of the waveforms.

- Atari Inc is using FORTH in two of its divisions and is rumored to be contemplating other uses for the language. In its Coin-Operated Division,

which develops and markets the stand-alone games found in pinball arcades and restaurants, a 6502-based development system employs FORTH software to debug and test arcade circuit boards. In addition, Atari has developed its own custom version of the language, called game-FORTH, that is awaiting its first use to replace machine code as the language used to create arcade games. Someday soon, you may play a coin-operated game without knowing that you are actually running a FORTH program.

In the Consumer Group of Atari, a version of FORTH that has been extended to allow manipulation of the video screen and game peripherals has been developed for the Atari 800 computer. Although no definite plans have been made, Atari may market it as an option for the Atari 800, or, like the Coin-Operated Division, use it in a "transparent" mode to implement games and other programs.

- FORTH is used in a portable 1802-based computer that aids in the treatment of patients with infrequent heart flutter. The device, small enough to be worn comfortably by

the patient during his or her daily activities, constantly updates a "snapshot" of the patient's heart activity every 7 seconds. In addition to recording this information in real time, the device analyzes the data for evidence of a heart murmur. When a murmur is detected, the device stores the data containing the evidence and signals the patient to return with the device to the doctor's office for analysis and diagnosis.

- In another medical application, FORTH is the sole language used in a computer at the Cedar-Sinai Medical Center in Los Angeles, California. Using FORTH, a Digital Equipment Corporation PDP-11/60 simultaneously performs, among others, the following tasks: manages 32 remote terminals; stores patient information from an optical reader into a large data base; runs a statistical package that analyzes the patient data base in search of trends in the physical makeup, treatment, and results of similar patients; and analyzes blood samples and heart behavior in real time while a patient is exercising on a treadmill machine. Spencer SooHoo, in the pulmonary

medicine section, is also developing a portable 6800-based FORTH system to be used for monitoring intensive-care patients.

- A stripped-down version of FORTH was used to create the hand-held Craig M100 Language Translator under time, size, and other design constraints. This same language also runs the software inside the translator unit. In a related product, a hand-held ASCII terminal manufactured by MSI Data Corporation of Costa Mesa, California, also uses FORTH internally.

- In what must be the most interesting FORTH application I have encountered, a central California fruit farming cooperative uses an 8080-based machine running FORTH to adaptively sort and grade peaches. Infrared sensors send information to the computer on the coloring and quality of pitted peach halves that pass the sensors on a conveyer belt. After analyzing this data, the FORTH program causes flippers to knock the peach halves into appropriately graded bins—extra fancy, fancy, etc. In addition, the program keeps track of the percentage of peaches in each bin and changes its selection criteria to maintain a certain fixed ratio among the various grades of peaches.

- Last but not least, FORTH is used in several aerospace applications. A FORTH-like language called IPS (running on an 1802-based system) is orbiting Earth in an amateur radio satellite called the OSCAR Phase III. Avco Inc is using another 1802-based system (again, for the small size and power consumption of the 1802 microprocessor) to monitor temperature and take care of ground-to-satellite and satellite-to-ground telemetry in a military satellite.

Who Should Try FORTH?

FORTH is an easy language: a high school student, Arnold Schaeffer, wrote an arcade-type game called BREAKFORTH. (See "Breakforth into FORTH," by A Richard Miller and Judy Miller, on page 150.)

FORTH is a difficult language: it easily beats APL as a "write-only language"; you can write a program in the language, but you can't easily read what you've written.

Given these two valid extremes, your initial reaction might be, "This doesn't make sense." True, learning

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BYTE LINES

NEWS AND SPECULATION ABOUT PERSONAL COMPUTING

Conducted by Sol Libes

Personal Computer **Prices Increasing:** Both Texas Instruments (TI) and Atari recently announced price increases for their personal computer systems. Radio Shack, Commodore, and Apple are holding the line, at least for the present.

Atari increased the price of its Model 400 from \$550 to \$630 and the Model 800 from \$1000 to \$1080. The company attributed the increase to rising component costs, particularly components that incorporate precious metals.

TI, on the other hand, has subtly unbundled the 99/4 system. Previously, a purchaser bought the keyboard/processor console and a 13-inch color video monitor for \$1150. Now he can buy the console for \$950 and the monitor for \$450, a total of \$1400. Or, he can buy the console and an RF (radio-frequency) modulator (\$75) and hook it up to a standard color television set. This combination costs \$1025, which is only \$125 less than the old complete system price.

Although Radio Shack, Commodore, and Apple have not raised the prices of their basic systems, certain peripheral devices and add-ons have increased in price. Furthermore, when the Federal Communications Commission (FCC) RF-radiation standards go into effect on January 1, 1981, there may be significant price increases.

Most personal-computer marketing experts agree that for personal computing to become a true mass

market, prices must decrease, not increase. The experts are therefore disturbed over what they feel will be a real damper to personal-computing sales.

Software Piracy: Over the years, software vendors have complained many times about hobbyists copying software from one another instead of buying it. One supplier even has gone so far as to offer a \$10,000 reward for information leading to the conviction of anyone found copying its software. I am not aware that this plan has had any positive results. It has, however, raised the ire of many hobbyists, and there may have been a negative effect on this particular supplier's software sales, because he sells cassette software mostly to hobbyists.

Although copying by hobbyists remains a problem for software vendors, a much greater problem has developed: software piracy for commercial purposes, by pirate vendors who are marketing copies in much the same way as audio- and videocassette pirates do.

For example, Nestar Systems of Palo Alto, California, has charged that its read-only-memory-based "Basic Programmer's Toolkit" (for the Commodore PET) is being distributed in Europe in both cassette and floppy-disk format. The pirating distributor is alleged to have changed the code (relocating it into user

memory) and to have changed the copyright notice. Nestar is taking action in this case.

This type of software piracy will have a more serious financial impact on the software vendor than hobbyist copying. Here, the vendor is actually losing dealer sales, since many dealers are purchasing the software from the pirate at a much lower cost—and probably marking it up more—than if the dealer purchased it from the legitimate vendor. In most instances, end users are not aware that they have purchased a pirated copy until they try to get software support from the rightful vendor.

Tektronix Sets Up **Handicapped Person's Hot Line:** Physically handicapped persons, or people wanting information on special electronic equipment for coping with physical impairments, can get answers to questions by calling the Tektronix Special Interest Group on Computers and the Physically Handicapped in Beaverton, Oregon, at (503) 357-4354.

Intel Releases Data on **32-Bit Microprocessor:** Intel, the recognized leader in microprocessor development, has "leaked" advanced information on three new forthcoming 16- and 32-bit microprocessors. Intel is now playing the game of trying to scoop its competition by

announcing products long before they will be available in production. This will, no doubt, have an impact on sales of the Zilog Z8000 and Motorola MC68000, as purchasers may now wait for a more powerful product.

The 32-bit microprocessor will be known as the iAPX-432, and will be a 3-chip set with a brand-new architecture and instruction set. Intel claims that it will provide the power of a medium-scale IBM 370 system. It will directly execute Ada code. Ada is an upward extension of Pascal, and it is the language designed for and to be used by the US Department of Defense. It is interesting to note that at this time there is no Ada compiler up and running.

The two new 16-bit microprocessors are essentially 8086s with integrated functions and higher speed to improve performance. They are intended for multiprogram and multi-user systems.

Intel promises that all three new microprocessors will be available in 1981, with the 32-bit microprocessor becoming available first.

Xerox Opens Computer **Stores:** The Xerox Corporation recently opened retail stores in Dallas, Texas, and Denver, Colorado. Apparently these are the first links in a chain of retail computer stores across the country. The store is selling Xerox 510 small-business computers, Apple II com-

AMSAT is continuing to develop software to be used by ground stations in the satellite networks and is seeking support from personal computer users in this software-development effort and in other areas of the rebuilding program. Information on AMSAT and its programs may be found in *Orbit*, which is published every two months and received by all members of the AMSAT group. A year's membership may be obtained for \$10 from AMSAT, POB 27, Washington DC 20044.

The AMSAT space program is not a complete loss, however. The Phase II OSCAR-8 satellite continues in orbit, and a group of radio amateurs from the University of Surrey in England will launch the scientific-research satellite UOSAT in late 1981. Carrying a coherent high-frequency beacon, a magnetometer, and a slow-scan television camera, the "bird" will provide opportunity for ham radio and personal-computer users to gain experience in tracking satellites and monitoring telemetry.

Random Bits: It is interesting to note that IBM, via its Science Research Associates subsidiary, is marketing the Atari personal computer to educational users. In fact, IBM is offering a special sale. If you buy one Atari Model 800 system, they will give you an Atari Model 400 system free....Avalon-Hill, well known in the war gaming field for its historical simulation board games, has introduced a line of microcomputer-assisted games for the TRS-80, Apple II, and Commodore PET....The sales of the Texas Instruments (TI) Model 99/4 personal computer have been so disappointing that in the Los Angeles area TI has started offering \$100 worth of free software plus a \$100 cash rebate....Apple Computer Company has shifted its

Apple II production from Silicon Valley to Carrollton, Texas, a mere 30 miles away from the new 100,000-square-foot plant Tandy has built to make TRS-80s....A record 82,000 people attended the National Computer Conference (NCC), in Anaheim, California, this past May. The NCC is the largest computer show in the world. When it was held in Anaheim two years ago, 55,000 attended, which set the record just smashed....Data General has begun selling its business-oriented microcomputer systems through independent computer stores nationwide....Fujitsu America Inc, Lake Bluff, Illinois, has announced a plug-in "Bubble Memory Cassette." It provides a portable, detachable, read/write block of 64 K bits. Fujitsu has also introduced a new fully-formed-character printer with speeds up to 80 cps (characters per second), nearly twice the speed of conventional daisy-wheel machines. The printer is currently offered as a \$4500 option to a word-processor system....Texas Instruments is now making the voice-synthesizer components used in the Speak & Spell and talking Language Translator available separately at \$13 in OEM (original equipment manufacturer) quantity....Shugart Technology, BASF, Control Data, and Erwin International, Ann Arbor, Michigan, are all expected to have 5-inch Winchester hard-disk drives available by the year's end....Commodore will be the first US manufacturer to use the new low-cost Shugart/Matsushita 5-inch floppy-disk drive....Zilog and Mostek have both announced that 6 MHz versions of the Z80 microprocessor will be available in production quantities next year.

Random Rumors: It is rumored that Commodore

will soon introduce two low-end personal-computer systems. One will be a black-and-white unit for under \$500 and the other a color unit for under \$800....Apple may be working on a low-end consumer computer that will compete with Mattel's Intellivision....Personal Software, Sunnyvale, California, the folks who brought out Microchess and VisiCalc (probably the two largest-selling personal-computer software packages to date) are rumored about to release VisiText, a superpowerful text editor with features never before seen....NEC (Nippon Electric Corporation) is rumored to be investigating selling its Model PC-8000 microcomputer here in the US, after selling it in Japan for some time.

IBM Demonstrates Continuous Voice Recognition:

IBM research scientists, at the Thomas J Watson Research Center in Yorktown Heights, New York, have demonstrated that continuous speech can be recognized by a computer with an accuracy of 91%. In continuous speech there are no pauses between words. In the IBM experiment, the computer transcribed normal-speed speech into printed form. The program took 100 minutes to display or type a transcript of a 30-second sentence. In other words, it has a 200:1 response-time ratio. The experiment proves that continuous speech recognition by computers is possible.

UCSID Pascal Controversy Continues:

Several former University of California, San Diego (UCSD) Pascal licensees are threatening to file suit against UCSD and its new exclusive licensee, SofTech Microsystems. The licensees charge that UCSD violated the "fair use doctrine" in arbitrarily cancelling their licenses

only a short time before the software would have entered the public domain.

About thirty organizations, mostly computer hobbyist clubs, paid \$200 to \$300 for a UCSD Pascal license that permitted distribution of the software to their members and, after two years, would have placed no restrictions on copying the software.

These licensees are also upset over what they charge to be software developed with public funds now being sold by a private organization. SofTech counters this charge by asserting that it is merely an agent of the university and that it intends to spend as much money on developing UCSD Pascal as did the university.

One UCSD Pascal purchaser had an uncancellable license: Apple Computer Company. Its license, however, is restricted exclusively to use of the software on Apple Computer systems.

Terminal Gets Voice Input:

Heuristics Inc of Sunnyvale, California, has introduced a speech-recognition system which works with a Lear Siegler ADM-3A video terminal. The unit, called VOCON 5000, recognizes 64 words or phrases that can control a program being run on the computer. A 99% recognition rate is claimed for the unit, which sells for \$2000.

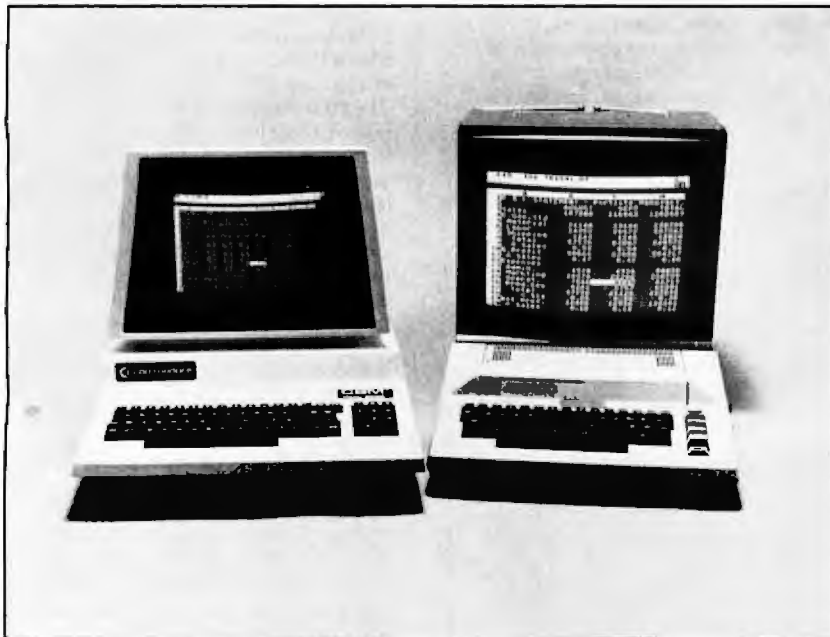
MAIL: I receive a large number of letters each month as a result of this column. If you wish a response, please include a stamped, self-addressed envelope.

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What's New?

SOFTWARE

VisiCalc Now Runs on PETs and Atari Machines



VisiCalc, from Personal Software Inc., 1330 Bordeaux Dr., Sunnyvale CA 94086, (408) 745-7841, is a software package that turns a personal-computer display into an interactive electronic worksheet. It is now available for the Commodore PET and CBM Model 8032 and Atari 800 computers. VisiCalc

creates a 64-column wide, 254-row high matrix on the screen. It is used instead of a calculator in businesses for inventory planning, sales forecasts, financial analyses, and modeling. Prices are available from local computer stores.

Circle 633 on inquiry card.

Cross Assemblers

These development systems feature a macroassembler, an interactive editor/assembler, and a text editor. They enable CP/M systems to serve as development stations for the Intel 8048 series, RCA COSMAC 1802/1804, National COP400 series, and the Zilog Z8 processors. The development systems share a common operational structure. The assemblers feature instruction mnemonics and syntax as defined by the processor manufacturers. The macro-assembler includes full macroassembly and conditional assembly features, as well as the ability to chain a series of source files together during a single assembly. Programs developed under these systems must be off-loaded to the target processor for testing. Each development system is available for \$150 on CP/M 8-inch floppy disks, 5-inch North Star or Micropolis Mod II disks. Contact Allen Ashley, 395 Sierra Madre Villa, Pasadena CA 91107, (213) 793-5748.

Circle 634 on Inquiry card.

Data Base for the Hewlett-Packard HP-85A

The EDIT Division of Physiologic Corporation, 3800 Woodward Ave., Detroit MI 48201, (313) 831-8800, has introduced EDIT-85 for the HP-85A computer. This data-base management system supports all standard EDIT features such as validity and range checking during data entry, unlimited user viewing of the data, output-format control, data compression, nested data relations within files, and menu-oriented user prompts. EDIT applications include check/request, invoice, mail list, purchase order/request, and quote functions. The EDIT-85 and EDIT-4050 tape cartridge-based systems purchase price is \$1750, and the lease/equity plan is \$110 a month. The introductory applications are \$50 each or \$200 for all five on one tape. All EDIT systems receive 1 year of update privileges and the EDIT newsletter.

Circle 635 on inquiry card.

Programs for Home Control

The Soft-Sonic programs provide for home control. They run on the Apple microcomputer with a BSR Ultrasonic System X-10 (Sears Home Controller). The package includes the transducer hardware, interface cable, and the programs on a floppy disk. The programs allow for control of lighting, appliances, and more, through user-defined timed sequences or by voice command using Heuristics Speech Lab. The price is \$39.95 from John Blankenship, BACE, POB 52785, Atlanta GA 30355.

Circle 636 on inquiry card.

The Dow Jones Connection

The Dow Jones Connection is a stock-management system that interfaces the TRS-80 to the Dow Jones computer in Princeton, New Jersey. Interaction with the Dow Jones network is automatic and virtually instantaneous. The first step is to create one or more portfolios of up to twenty-five stocks each. When the portfolio is completed, a second program requests the user password and prepares the data for interrogation of the Dow Jones computer. A telephone call connects the two systems. Hard copy of the data can also be obtained through the user's printer. The Dow Jones Connection requires a TRS-80 Model I or II disk system or a Model I cassette system with a minimum of 32 K bytes of memory, and a Micro Connection modem which has an RS-232 output that can be used to drive a serial printer. For additional information, contact The MicroPeripheral Corporation, POB 529, Mercer Island WA 98040, (206) 454-3303.

Circle 637 on inquiry card.

Color-Enhanced Business Packages

Peachtree Software has announced a color-enhanced version of its general business packages. The packages have been modified for the CP/M-compatible Intecolor unit at Intelligent Systems Corporation of Norcross, Georgia. Initially offered are the Accounting, Inventory, and Mailing Address systems. For more information, contact the marketing department, Retail Sciences Inc., 3 Corporate Sq., Suite 700, Atlanta GA 30329, (404) 325-8533.

Circle 638 on inquiry card.

What's New?

SOFTWARE

A Mail-List and Data-Base System

SelectraSort is a mail-list, data-base management system. It can pull records from mail-list files on the basis of over sixty selection criteria. The mail-list-file maintenance module enters new records to the mail list and changes or deletes existing entries. The selection module pulls records from the files. The print module prints selected and master mail lists as well as mail labels. Sorts can be done by ZIP code, country, state, last activity date, amount purchased or sold last year and this year. SelectraSort is \$195, which includes CBASIC source code. It is available on 8-inch soft-sectored and 5-inch soft- and hard-sectored floppy disks. Contact Software Hows, a division of MicroDaSys, POB 36275, Los Angeles CA 90036, (213) 731-0877.

Circle 677 on inquiry card.

General Ledger for the Atari

MicroLedger, the Compumax general ledger program, has been converted to run on the Atari 800. The Atari MicroLedger performs trial balances and produces profit-and-loss statements and balance sheets. It features updating options, allowing the user to review and update records in the journal or chart of accounts; a running balance column in the journal listing; and error traps. The MicroLedger package retails for \$140, which includes the program, sample data, and a manual. BASIC source code is also included. Minimum hardware requirements are the Atari 800 with 24 K bytes of memory and a floppy-disk drive; a printer is offered as an option. Contact Compumax Inc, POB 1139, Palo Alto CA 94301, (415) 325-4503.

Circle 678 on inquiry card.

Data Manager for the Apple

Information Master is a data manager for use with the Apple and includes the ability to do calculations, totals, sub-totals, and more. The program lets the user define, enter, edit, sort, and retrieve data. Printed report formats using the report-generation features can be defined. Other features include screen formatting, error trapping, and the ability to add, multiply, divide, and do exponentiations. A program is included that transfers files from the Management System for use with the Information Master. For further details on the Information Master program, contact High Technology Inc, POB 14665, 8001 N Classen Blvd, Oklahoma City OK 73113, (405) 840-9900.

Circle 679 on inquiry card.

Vector Releases COBOL with Program Generator

Vector Graphic Inc has released a version of its ANSI-standard CIS COBOL, featuring program generation capability. Version 4.2 of CIS COBOL implements the eight modules necessary to meet the ANSI Level 1 standard at the low-intermediate level. The FORMS-2 utility generates data-entry screens and can create error-free data input programs without the programmer writing a line of code. It is available from Vector Graphic Inc, 31364 Via Colinas, Westlake Village CA 91361, (213) 991-2302.

Circle 680 on inquiry card.

Job-Costing Package Under CP/M

This job-costing package consists of a reporting facility, a job-costing accounts payable, and a job-costing payroll. These programs are designed to run on a Z80 or 8080 processor using the CP/M operating system. Other CP/M-like systems are also supported. The software will run on hard or floppy disks. The business applications are integrated, yet each will run singly. The price is \$700 for a system from Arkansas Systems Inc, Suite 206, 8901 Kanis Rd, Little Rock AR 72205, (501) 227-8471.

Circle 681 on inquiry card.

Business Application for the HP-85

Pro-Flow can figure sales analysis, forecast performance for products, evaluate material costs, and perform cash-flow analysis for a year's operation. By mixing initial raw data values with formulas, users can make projections about future operations. Pro-Flow is designed to run on the HP-85 micro-computer. It is available at a suggested retail of \$150 from Scelbi Publications, 20 Hurlbut St, Elmwood CT 06110, (203) 522-5515.

Circle 682 on inquiry card.

Disk-O-Tape

Disk-O-Tape is a utility program for the Apple II and Apple II Plus computers. It enables users to transfer the data from a floppy disk to cassette tape and back again. The program features sector-by-sector copy of a DOS 3.2 disk to tape, error detection, and a verification pass for reliability. Each tape produced by the program contains a bootstrap for easy loading on disk. The program allows user-assigned naming of tapes. Disk-O-Tape requires at least 32 K bytes of programmable memory. The program comes on a floppy disk with Testape, a program to aid in adjusting the cassette recorder for optimum performance. Disk-O-Tape costs \$12 from Dann McCreary, POB 16435-B, San Diego CA 92116.

Circle 683 on inquiry card.

Lifeboat Supports the Durango F-85

Lifeboat Associates has made available its 8080 software line formatted for the Durango F-85 computer. This software, which includes languages such as BASIC, COBOL, and Pascal; word-processing systems, such as Wordstar; communication software, such as BSTAM; and complete accounting packages, is available by the implementation of CP/M. The first version of CP/M supports the F-85 with up to four floppy-disk drives. This is priced at \$170. Later versions will support the 12-megabyte and 25-megabyte hard-disk systems. Contact Lifeboat Associates, 1651 Third Ave, New York NY 10028, (212) 860-0300.

Circle 684 on inquiry card.

RECLAIM "Hides" Bad Sectors and Tracks from CP/M

Lifeboat Associates, 1651 Third Ave, New York NY 10028, (212) 860-0300, has announced a CP/M 2.0 utility program that tests floppy-disk and hard-disk systems for error-prone parts of the disk and allocates those parts to files that are invisible to the user. RECLAIM maps the bad spots out of the file directory so that they cannot be used again. It safely tests the disk with or without data files. At the completion of the program, it announces the number of blocks hidden from the file system. RECLAIM is available on all CP/M media formats supported by Lifeboat Associates. The cost is \$80.

Circle 685 on inquiry card.

Interfacing a Joystick

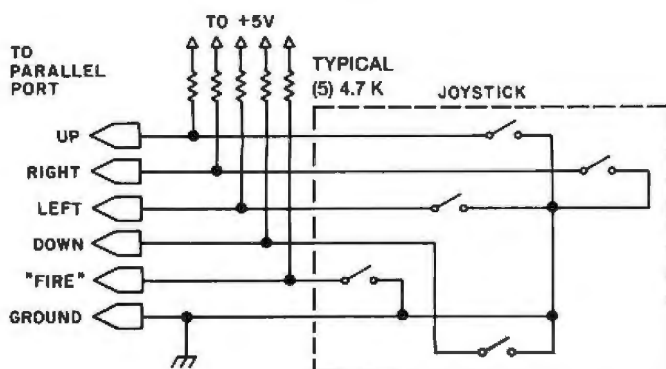
Dear Steve,

I would like to interface an Atari joystick (made up of simple switches, not potentiometers) to the input port of my Exidy Sorcerer microcomputer. I don't believe the software will be difficult, but do I hook up the "common" wire from these switches to +5 V, and each lead to an input bit on the port? Are "tie-up" resistors required?

Richard Legault

Although I am not familiar with the Sorcerer, I assume that the input port is TTL (transistor-transistor logic) or LSTTL (low-power Schottky TTL); if so, I suggest that you attach a pull-up resistor and switch to each bit as shown in the diagram (see figure 2). When the switch is open, a logic 1 is presented to the input port; when the switch is closed, a logic 0 is presented....Steve

Figure 2



construct should be of reasonable cost (\$50 or so), show the basic workings of a microprocessor, and still be of some use to me in my home or on my farm. The unit could also incorporate photoelectric or heat-sensor devices. I have failed so far to find anything that fulfills my requirements. Do you know of any plans or kits that are close to what I am describing?

I would very much appreciate it if you could spare some time and do some searching for me. My science fair is about a month away, so I need your advice as soon as possible.

Kevin Meysenburg

I can think of a few ways for you to build an under \$50 computer, but not in less than a month. To keep costs down, it would have to be built from scratch. If it used a printed-circuit board, it would be much more expensive. There have been circuits for microcomputers in BYTE and other maga-

zines many times within the past three years. I suggest you check the back issues or request an index from the magazines.

Once you have a circuit, you will still need the parts. You may be unaware that some companies, notably Intel, practically give away whole computers in the name of education. Write to Intel Corporation, calling attention of the product manager to the particular microprocessor you are interested in, and ask about the price and delivery of "University Kits." These are functional, cosmetically rejected devices that are practically given away for a nominal handling charge. In 1976, people were getting 8080A kits including programmable memory, EPROMS (erasable program-mable read-only memories), and I/O (input/output) devices, worth about \$800 from the distributors, for \$20. I'm sure other companies have the same interest in supporting the schools....Steve

Periodical Guide

Dear Steve,

I am currently building a Central Data 2650 computer system, which uses S-100 circuit boards for memory and I/O (input/output). Could you please send me a list of construction articles that have appeared in BYTE and other magazines that might help me?

Kenneth Johnston

clude both subject and author indexes for over 9800 articles from BYTE, Electronics, Computer Design, Radio Electronics, and twenty other magazines.

The guides include listings under such varied topics as construction, languages, and robotics. These guides should help you find what you want....Steve

Quick and Cheap

Dear Steve,

For my high school science fair project, I am interested in building a microcomputer to show the advantages and uses of a microprocessor. I have not been able to find suitable plans, and I think that you can help me.

The unit I would like to

In "Ask BYTE," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

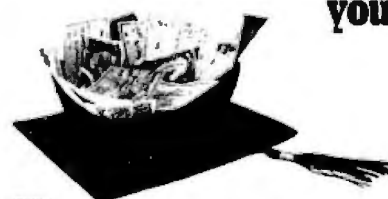
Ask BYTE

c/o Steve Ciarcia
POB 582

Glastonbury CT 06033

If you are a subscriber to The Source, send your questions by electronic mail or chat with Steve (TCE317) directly. Due to the high volume of inquiries, personal replies cannot be given. Be sure to include "Ask BYTE" in the address.

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An Introduction to Atari Graphics

Chris Crawford and Lane Winner
Atari Inc
1272 Borregas Ave
Sunnyvale CA 94086

The Atari 400 and 800 are second-generation personal computers. In addition to the normal memory and processor integrated circuits, they contain three special-purpose LSI (large-scale integrated) circuits which make them capable of many feats of computing legerdemain. Most of this power, however, lies brooding beneath many layers of "human engineering." The beginning programmer working in BASIC is paternalistically protected from the complexities and power of the beast within. The more experienced programmer seeking cybernetic high adventure must first defeat the friendliness engineered into the machine to unleash its throbbing brute power. Without help, this can be most difficult. We will act as native guides for one region of this complex machine: the *display list*. We will show you how to generate flashy displays by creating you own display list and redefining the character set.

Display-List Fundamentals

Most personal computers use a straightforward memory-mapped display in which the screen format is fixed and each screen pixel's (picture element's) contents are provided by a specific location in memory. This is a simple scheme demanding little of either the programmer or the computer. The Atari 400/800 uses a more complex scheme involving a display list and display data. A *display list* is a sequence of commands that defines the vertical format of the video display; the *display data* is the information to be displayed.

The Atari 400/800 display list is actually a small pro-

gram; it is processed by a special LSI circuit called ANTIC. ANTIC is a dedicated microprocessor whose sole function is to control the video display. ANTIC uses a process called DMA (direct memory access) to gain access to the display list and display data. The display list and display data are stored by the high-speed (1.8 MHz) 6502 microprocessor. When the BASIC programmer types GRAPHICS *n*, the operating system writes a complete display list into memory and clears the display data. The information flow for this process is diagrammed in figure 1. Clearly, the adventurous programmer who bypasses BASIC and writes his or her own display list will have more direct control over the screen.

Associated with the display list are the concepts of a graphics mode and a graphics-mode line. The Atari 400/800 supports fourteen fundamental graphics modes, only nine of which are directly accessible from BASIC. The first six modes (three of which are accessible from BASIC) are character modes which display characters in different combinations of size and color. The remaining eight graphics modes display squares of color in different resolution and color combinations. A *graphics-mode line* is a group of horizontal-scan lines which are treated as a unit for display purposes. (A horizontal-scan line is a single sweep of the electron beam across the television screen. There are 192 horizontal-scan lines in the visible area of the screen.) A graphics-mode line will contain between one and sixteen horizontal-scan lines, depending on the graphics mode involved. A graphics-mode line stretches horizontally all the way across the screen (you

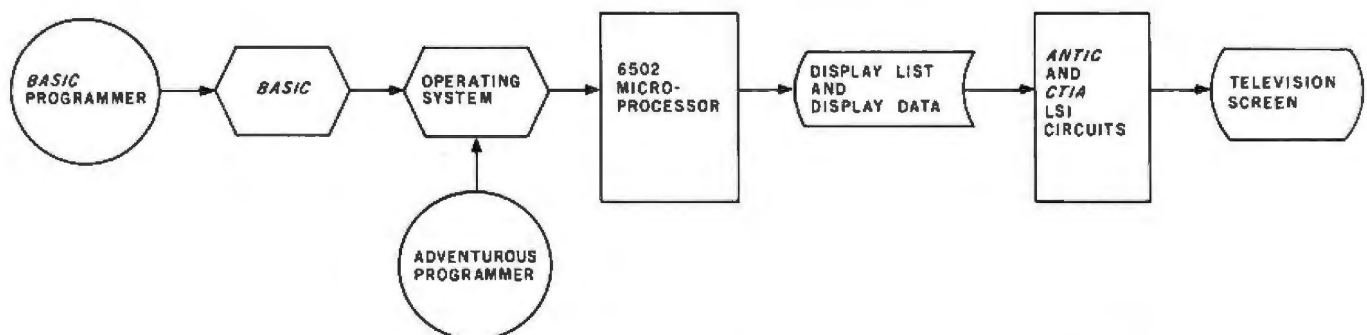


Figure 1: Information flow for Atari 400/800 display. The adventurous programmer who bypasses BASIC gains more control over the display list and display data, and thus is able to customize the displayed image to a greater extent.

cannot change graphics modes halfway across the screen). The video display is thus organized as a vertical sequence of mode lines of varying height and contents. There are many thousands of possible sequences of mode lines on the screen; BASIC restricts the programmer to seventeen such sequences. Each such sequence is referred to in the BASIC manual as a graphics mode.

Display-List Details

The display list and the display data normally reside at the top of available memory-address space. Since the amount of available memory is not fixed, the operating system must keep track of the address of the display list. The address of the beginning of the list is stored in decimal addresses 560 and 561. The first 3 bytes in the display list skip twenty-four blank scan lines, which is necessary to defeat the vertical overscan of many television sets. The next byte is called the LMS (load memory scan) byte. It defines the first mode line of the display and also instructs ANTIC that the following 2 bytes give the address at which display data can be found. Since we rarely need to tamper with these first 4 bytes, we will start with the fifth byte, whose address we will assign to a BASIC variable called START. The value of START can be calculated by:

$$\text{START} = \text{PEEK}(560) + 256 * \text{PEEK}(561) + 4$$

The bytes at this location and the succeeding location give the starting address of the display data. Beginning at location START+2 is a sequence of mode bytes which specify the mode lines for the display. The codes for these mode bytes are found in table 1. The programmer has the freedom to create any sequence of mode bytes for the display list. The programmer also has the responsibility to insure that the chosen sequence includes exactly 192 horizontal-scan lines. At the end of the mode-byte sequence, the programmer must place an ANTIC JUMP byte (decimal 65) followed by the low- and high-order address bytes of the beginning of the display list—four bytes lower in memory than the location we refer to as START.

The starting address of the display data, which we will assign to a BASIC variable called MEMST, can be calculated from:

$$\text{MEMST} = \text{PEEK}(\text{START}) + 256 * \text{PEEK}(\text{START} + 1)$$

The display data is simply strung together in sequence; this can cause a headache when mixing modes. Since different mode lines require different numbers of display-data bytes, the programmer wishing to change a display-data byte must calculate its position in display-data memory by adding up the space requirements of each previous mode line. The BASIC POSITION and PLOT commands work reliably only with the homogeneous display lists used by BASIC, so the programmer who mixes modes must expend greater effort to use such a specialized display.

A Real Display List

We shall now illustrate these principles with a sample program and its resultant display, display list, and display data. The program is a straightforward affair which plots the BYTE logo in graphics mode 7+16. The pro-

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Mode	Remark	Left 4 Bits	Right 4 Bits	Color Dots Per Pixel	Scan Lines Per Mode Line	Number of Colors	BASIC Mode	Bytes Per Line
character	1	0	2	1/2	8	1 1/2	0	40
character	1	0	3	1/2	10	1 1/2	—	40
character	1	0	4	1	8	4	—	40
character	1	0	5	1	16	4	—	40
character	1	0	6	1	8	5	1	20
character	1	0	7	1	16	5	2	20
character	1	0	8	4	8	4	3	10
character	1	0	9	2	4	2	4	10
graphic	1	0	A	2	4	4	5	20
graphic	1	0	B	1	2	2	6	20
graphic	1	0	C	1	1	2	—	20
graphic	1	0	D	1	2	4	7	40
graphic	1	0	E	1	1	4	—	40
graphic	1	0	F	1/2	1	1 1/2	8	40
special	2	0-7	0	Blank	—	—	—	—
special	3	4	1	JUMP	—	—	—	—

Table 1: Interpretation of the graphics-mode-byte codes. Remarks are as follows:

1. The left nybble of the very first mode byte of the display list must be changed from 0 to 4.
 2. The blank mode is used to output a selected number of blank background lines.
 3. The JUMP instruction causes the ANTIC graphics processor to recognize the end of the display list and return to the beginning of the list, waiting for vertical blanking to occur so it can proceed with another frame.
- Where 1 1/2 colors are indicated, the hue of the foreground color cannot be controlled.



Photo 1: The BYTE logo as displayed by the Atari 400/800 running the program of listing 1. See table 2 for details.

gram is presented in listing 1 (page 24), and the display it produces is shown in photo 1. Figure 2a and table 2a show the display list for this display. Since this is a standard BASIC graphics-mode display list, it is neat and tidy.

Tampering With the Display List

With the formal goal of improving the display and the heuristic goal of demonstrating display-list manipulations from BASIC, we shall now tamper with this display list. The first step in this process is to prepare our proposed display list on paper. The desired screen format is shown in figure 2b.

We must consult table 3 to determine which of the display modes will require the greatest amount of memory space. In our case, we are using modes 0, 1, 2, and 7; mode 7 is clearly the most memory-intensive mode. We shall therefore start with mode 7 and modify the mode-7 display list. It is always easier to pare down an oversized display list than to build up an undersized one.

Next, we must verify that our proposed display list does indeed produce 192 horizontal-scan lines. Consult table 1 to find the number of scan lines per mode line. Our calculation produces the following results:

Mode	Number of Mode Lines	Scan Lines Per Mode Line	Total Scan Lines
0	1	8	8
1	4	8	32
2	4	16	64
7	44	2	88
			192 Total

We now determine the mode bytes for each of the mode lines by looking them up in table 1. It is handy to convert these to decimal for later use. Our results are:

Mode	Hexadecimal Mode Byte	Decimal Mode Byte
0	02	2
1	06	6
2	07	7
7	0D	13

Listing 1: Atari 400/800 program to plot the BYTE logo, shown in photo 1. See table 2 on page 26 for details.

```

100 GRAPHICS 7:COLOR 1:POKE 765,1:POKE 710,128:POKE 712,128
110 A=0:READ B,C:IF B>-1 THEN GOSUB 800:GOTO 110
120 READ A,B,C:IF A>-1 THEN GOSUB 800:GOTO 120
130 END
800 ON A+1 GOTO 810,820,830
810 PLOT B,C:RETURN
820 DRAWTO B,C:RETURN
830 POSITION B,C:XIO 18,16,0,0,"S":RETURN
900 DATA 111,30,111,31,110,31,109,31,108,32,107,33,107,34
905 DATA 106,35,106,36,107,37,107,38,108,39,109,40,110,40,111,40
910 DATA 111,41,110,41,109,41,108,42,107,43,107,44,106,45
915 DATA 106,46,107,47,107,48,108,49,109,50,110,50,111,50,111,51
920 DATA -1,-1,1,97,51,2,96,50,1,96,50,2,96,31
925 DATA 2,97,30,0,93,31,1,92,31,1,91,31,1,90,32,1,89,33,1,89,34
930 DATA 1,88,35,1,88,50,1,87,51,1,80,51,2,79,50,0,79,50
935 DATA 2,79,35,0,79,35,2,78,34,0,78,34,2,78,33,0,78,33,2,77,32
940 DATA 0,77,32,2,76,31,1,74,31,1,74,30,1,93,30,0,71,30
945 DATA 1,71,46,1,70,30,1,70,46,1,69,43,1,69,46,1,68,44,1,68,46
950 DATA 1,67,44,1,67,50,1,66,51,1,59,51,2,58,50,0,58,50
955 DATA 2,58,46,1,54,46,2,54,44,1,64,43,1,63,42,1,63,31,1,62,30
960 DATA 1,55,30,2,54,31,0,54,31,2,54,43,0,51,31
965 DATA 1,51,39,0,51,42,1,51,50,1,50,51,1,50,42,0,50,39,1,50,30
970 DATA 1,49,30,1,49,32,0,49,33,1,49,43,0,49,49
975 DATA 1,49,51,1,48,51,1,48,50,0,48,42,1,48,39,0,48,31,1,48,30
980 DATA 1,46,32,0,46,38,0,46,43,0,46,49,1,45,46,1,45,43
985 DATA 0,45,38,1,45,33,0,47,51,1,36,51,2,35,50,0,35,50,2,35,31
990 DATA 1,36,30,1,49,30,-1,0,0

```

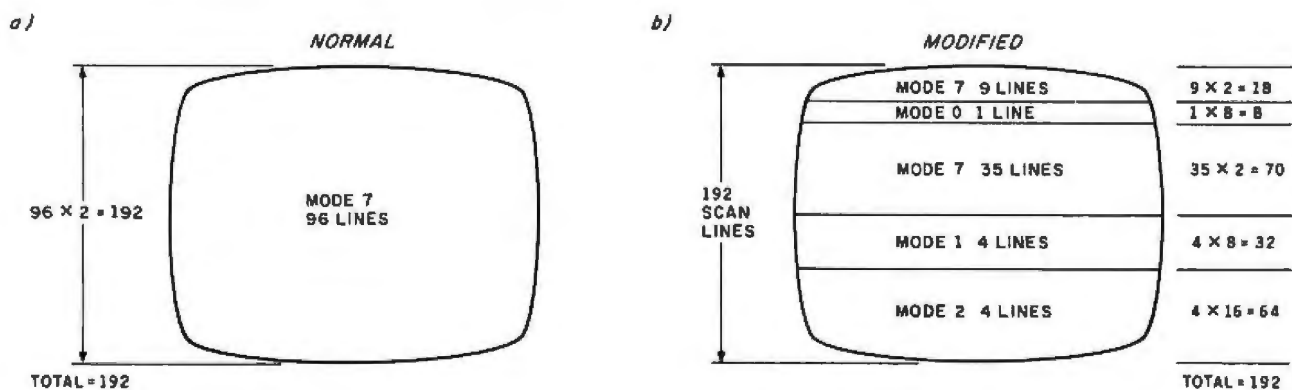


Figure 2: Horizontal-scan line arrangement for normal- and modified-display screens. The video screen in figure 2a is composed completely of mode-7 horizontal lines. In figure 2b, the video screen is constructed from multiple-mode sections that allow a mix of images to be displayed. Refer to table 2 for details.

The results of this paperwork are presented in table 2b.

Now, at last, we are ready to write some code. Please refer to listing 2 on pages 28 and 30 in conjunction with this narrative. We begin by checking to see that there is enough memory available to reposition the display list (line 0). If there isn't enough, the program aborts. We then move the top of available memory down by 4 K bytes and execute a GRAPHICS call (line 20) to write a

new display list and display data in memory. This procedure reserves 4 K bytes of memory for our own use later on. We then define our display strings (lines 30 and 40) and execute another GRAPHICS call to initialize our display list—which we shall subsequently modify. The series of POKes in lines 50 and 55 define the colors we will be using and turn off the character display while we redefine our characters.

Listing 2: Atari 400/800 program to plot the BYTE logo and the other characters as displayed in photo 2.

```

0 IF FRE(0)<5825 THEN PRINT "NOT ENOUGH MEMORY!":END
20 RAMTOP=PEEK(106):POKE 106,RAMTOP-16:GRAPHICS 0
30 DIM SML$(32):SML$(1,32)=" the small systems Journal "
40 DIM MGH$(41):MGH$(1,41)="@@@A@McGRAW@HILL@@@@@PUBLICATION"
50 GRAPHICS 7+16:COLOR 2:POKE 765,2
55 POKE 708,128:POKE 709,40:POKE 710,128:POKE 712,128
60 START=PEEK(560)+PEEK(561)*256+4
70 POKE START+10,2
80 FOR X=0 TO 3:POKE START+46+X,6:NEXT X
90 FOR X=0 TO 3:POKE START+50+X,7:NEXT X
95 POKE START+54,65:POKE START+55,PEEK(560):POKE START+56,PEEK(561)
110 A=0:READ B,C:IF B>-1 THEN GOSUB 800:GOTO 110
120 READ A,B,C:IF A>-1 THEN GOSUB 800:GOTO 120
200 CHBAS=RAMTOP-4:ADDR=CHBAS*256
210 FOR X=0 TO 1023:POKE ADDR+X,PEEK(57344+X):NEXT X
220 POKE 756,CHBAS+2
230 FOR X=0 TO 255:POKE ADDR+512+X,PEEK(ADDR+256+X):NEXT X
240 FOR X=0 TO 7:POKE ADDR+512+X,0:NEXT X
250 FOR X=0 TO 7:READ A:POKE ADDR+99*8+X,A:NEXT X
290 POKE 755,0:POKE 87,0
300 POSITION 4,9:? #6:"AUGUST 1980 Volume 5, Number 8";
310 MEMST=PEEK(START)+PEEK(START+1)*256:CHRPOS=MEMST+46*40
320 FOR X=1 TO LEN(SML$):POKE CHRPOS+X-1,ASC(SML$(X,X))+128:NEXT X
330 CHRPOS=CHRPOS+60
340 FOR X=1 TO LEN(MGH$):POKE CHRPOS+X-1,ASC(MGH$(X,X))-64:NEXT X

```

Listing 2 continued on page 30

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- . balance inquiry
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ADDRESS _____ CITY _____ STATE _____ ZIP _____

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Name and type of system _____

Do you have communications capability? _____

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New York, New York 10101

BY

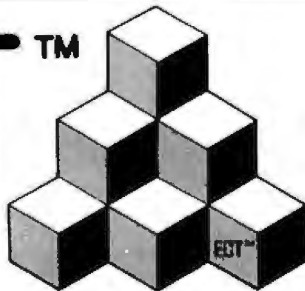
Listing 2 continued:

```

350 POKE 708,200
360 GOTO 360
800 ON A+1 GOTO 810,820,830
810 PLOT B,C:RETURN
820 DRAWTO B,C:RETURN
830 POSITION B,C:XIO 18,6,0,0,"S":RETURN
900 DATA 111,20,111,21,110,21,109,21,108,22,107,23,107,24
905 DATA 106,25,106,26,107,27,107,28,108,29,109,30,110,30,111,30
910 DATA 111,31,110,31,109,31,108,32,107,33,107,34,106,35
915 DATA 106,36,107,37,107,38,108,39,109,40,110,40,111,40,111,41
920 DATA -1,-1,1,97,41,2,96,40,1,96,40,2,96,21
925 DATA 2,97,20,0,93,21,1,92,21,1,91,21,1,90,22,1,89,23,1,89,24
930 DATA 1,88,25,1,88,40,1,87,41,1,86,41,2,79,40,0,79,40
935 DATA 2,79,25,0,79,25,2,78,24,0,78,24,2,78,23,0,78,23,2,77,22
940 DATA 0,77,22,2,76,21,1,74,21,1,74,20,1,93,20,0,71,20
945 DATA 1,71,36,1,70,20,1,70,36,1,69,33,1,69,36,1,68,34,1,68,36
950 DATA 1,67,34,1,67,40,1,66,41,1,59,41,2,58,40,0,58,40
955 DATA 2,58,36,1,54,36,2,54,34,1,64,33,1,63,32,1,63,21,1,62,20
960 DATA 1,55,20,2,54,21,0,54,21,2,54,33,0,51,21
965 DATA 1,51,29,0,51,32,1,51,40,1,50,41,1,50,32,0,50,29,1,50,20
970 DATA 1,49,20,1,49,22,0,49,28,1,49,33,0,49,39
975 DATA 1,49,41,1,48,41,1,46,40,0,48,32,1,48,29,0,48,21,1,48,20
980 DATA 1,46,22,0,46,28,0,46,33,0,46,39,1,45,36,1,45,33
985 DATA 0,45,28,1,45,23,0,47,41,1,36,41,2,35,40,0,35,40,2,35,21
990 DATA 1,36,20,1,49,20,-1,0,0
999 DATA 0,60,96,96,96,60,0,0

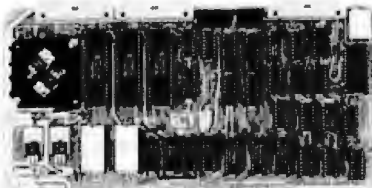
```

ECTTM



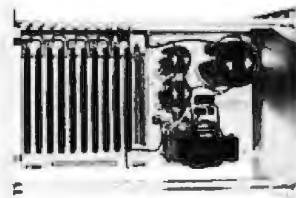
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Photo 2: The BYTE logo as displayed by the Atari 400/800 running the program in listing 2.

8 BY 8 PIXEL SQUARE	BINARY	HEXADECIMAL	DECIMAL
	0 0 0 0 0 0 0 0	0 0	0
	0 0 1 1 1 1 0 0	3 C	6 0
	0 1 1 0 0 0 0 0	6 0	9 6
	0 1 1 0 0 0 0 0	6 0	9 6
	0 1 1 0 0 0 0 0	6 0	9 6
	0 0 1 1 1 1 0 0	3 C	6 0
	0 0 0 0 0 0 0 0	0 0	0
	0 0 0 0 0 0 0 0	0 0	0

Figure 3: The assignment of values to create an elevated lowercase "c" character.

Text continued from page 26:

not uppercase and lowercase together—at least not in GRAPHICS 1 or 2. Since we want uppercase and lowercase together, we will have to redefine the character set.

To do this, we must have some memory reserved for the new character set. Line 20 did this by fooling the operating system into believing that the top of memory (called RAMTOP) lies sixteen pages lower than it actually does. This has reserved 4 K bytes for our use. The character set needs only 1 K bytes, but the display data cannot cross a 4 K boundary (without entailing difficulty), hence we must move the display list and display data down by an entire 4 K. The address of the beginning of our new character set is calculated in line 200 and is called ADDR.

In line 210, we move the original character set (starting at address 57344 in ROM) into user memory. In line 220, we tell the operating system where the new character set is. In line 230, we move the uppercase characters into the positions previously occupied by punctuation. Our new 64-member character set has uppercase and lowercase, but very little punctuation. In line 240, we define a new space character, as the original space character was part of the old punctuation group. We shall use the place previously occupied by the @ character for our space character.

We next take this technique of defining our own characters one step further. We had earlier decided to elevate the lowercase "c" in "McGraw-Hill." To do this, we must redefine what a lowercase "c" looks like. This is done in

The Atari 400/800 display list is actually a small program.

line 250, with data coming from line 999. Obviously, this procedure can be greatly extended. The diligent programmer can define any character set that can be expressed in an 8- by 8-pixel grid and POKE it into user memory directly (see figure 3). Greek, Cyrillic, or special technical character sets can be created in this way.

We now have our display list and character set in order. We need only display our text. This is done starting at line 290. The first POKE suppresses the cursor for a neater display; the second POKE fools the operating system into believing that it is working in mode 0. This prepares the way for a straightforward POSITION and PRINT of the first text line. The only trick is that the line is positioned vertically according to the number of mode lines from the top of the screen.

The next two text lines pose a particularly knotty problem. We desire to print GRAPHICS 1 and 2 characters on mode lines 46 thru 52. Neither graphics mode allows so many lines; when we try to position the cursor onto line 46 the computer will generate a "cursor out of range" error. Our only recourse is to POKE the character bytes directly into the display memory. We do this starting at line 310. First, we calculate the starting address of the display memory (MEMST). Then we calculate the address where our characters are to be stored (CHRPOS). Our calculation relies on the fact that the characters are on the 46th line and all previous lines used 40 bytes each. In more complicated situations, we would have to add up the byte requirements of all previous lines. This can get messy when a display mixes mode-1 or mode-2 lines at 20 bytes per line with other modes that use 40 bytes per line. Fortunately, our case is simple. Once CHRPOS has been calculated, we POKE the character values into the display data using a simple loop (line 320). Adding 60 to CHRPOS (line 330) skips three of our 20-byte mode-1 or mode-2 lines. We then POKE the character values for our third text line using the same technique we used in line 320, except that a different character-value offset (-64 instead of +128) gives us green characters instead of red ones. Line 350 turns the characters back on.

Conclusion

The two major tricks we have demonstrated in this article (modifying the display list and redefining the character set) will greatly extend the graphics and display power of your BASIC programs. The Atari 400/800 running BASIC alone has stunning graphics capabilities. With these tricks, the machine brings previously unheard-of capabilities into the hands of the personal computer owner. Yet, we are still just trundling down the runway. There are even grander functions built into this machine—movable graphics objects for animation, vertical and horizontal fine scrolling, and display-list interrupts, to name a few. With these tricks in hand, we can soar beyond the limits of yesterday's color display and animation. ■

What's New?

PERIPHERALS

Touch-Input Video Display



The VuePoint touch-input terminal is 7 cm (2¾ inches) thick and has a 12-line by 40-character flat-panel display. VuePoint's controller provides for up to fifty-one pages of information. A response is sent to the host computer by finger contact to any one of 240 discrete touch-sensitive locations of the display screen. Communication is by selectable 300 to 19,200 bps

(bits per second) data rates via an RS-232 interface. The controller for the display can be placed up to ten feet from the display. Prices begin at \$3500. For more information, contact General Digital Corporation, 700 Burnside Ave, East Hartford CT 06108, (203) 289-7398.

Circle 450 on inquiry card

Atari Memory Expansion Kit Has Supporting Software

This memory expansion kit will upgrade Atari 8 K-byte programmable memory boards to 16 K bytes. The kit provides five times more program space in high-resolution graphics and allows access to

higher resolution graphics. The \$79.95 price includes all hardware and instructions. Software support includes graphics programs like Plot & Draw, which generates graphics quickly while saving data for incorporation into BASIC programs. For more information, contact Mosaic Electronics, POB 748, Oregon City OR 97045, (503) 655-9574.

Circle 451 on inquiry card

The Model 460 Paper Tiger Printer

The Model 460 printer has throughput speeds of up to 160 cps (characters per second), can produce letter-quality print, and provides a variety of programmable print-control functions. The 460 employs a horizontal and vertical overlay dot-matrix character formation technique and a 9-wire bidirectional print head. Control functions include proportional spacing, bold text printing, and print densities of 10, 12, or 16.7 characters per inch. Automatic text justification, programmable horizontal and vertical tabbing, reverse paper feed, and positioning of characters to 1/20 of an inch are other control features of the printer. It can print in 80-, 96-, and 132-column formats. Foreign or custom character sets can optionally be added to

or replace the standard ASCII (American Standard Code for Information Interchange) character set; the printer allows uppercase and lowercase characters with descenders. Forms control features include programmable top and bottom of form, perforation skip, and vertical and horizontal tabs. A microprocessor provides an automatic memory, electronics, and print capability test. A 2 K-byte buffer and the ability to print graphics such as bar codes, block letters, and illustrations are included. The 460 has an RS-232C serial and a Centronics-compatible parallel interface. Data rates from 110 to 9600 bps are switch-selectable. The price for the Model 460 Paper Tiger printer is \$1295 from Integral Data Systems Inc., Milford NH 03055, (603) 673-9100.

Circle 452 on inquiry card

Three HP-85 Interfaces

The three HP-85 interfaces are a serial (RS-232C-compatible) interface card, a general-purpose parallel I/O (input/output), and a BCD (binary-coded decimal) card. The serial-interface card provides the HP-85 with bit-serial asynchronous data communication capability, with support for RS-232C and current loop operations. Features include: user-programmable data rates, parity, bits per character, and stop bits without changing physical switch settings. Other features include full-duplex with I/O buffers, and a 20 mA current loop. This card allows printers, modems, and other peripherals to be used with the HP-85.

The general-purpose interface card provides bit-parallel byte- and word-oriented interfacing. Two bidirectional ports and two output-only ports are on the card. The card can be configured as four separate 8-bit ports, two 16-bit ports, or two 8-bit and one 16-bit ports. Paper-tape readers, punchers, and card readers can be interfaced with this card.

The BCD card permits all data to be present simultaneously on a set of 48 wires. Instruments can output up to eleven BCD digits; two BCD instruments can be accommodated with the card. Typical applications for this card are in voltmeters, counters, medical equipment, and electronic scales. The serial-interface card is \$395 and the other cards are \$495. Contact the Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Rd, Palo Alto CA 94304, (415) 857-1501.

Circle 453 on inquiry card

6800/6809 I/O Boards by Gimix

The Gimix 2-port serial I/O board has two independent RS-232-compatible I/O ports, with handshaking, on a 30-pin board. It features programmable pinouts and independent data rate and interrupt jumpers for each port. The board is compatible with the SS-50 and SS-50C bus configurations. The 2-port board, less cables, is priced at \$128.43.

Also available is an 8-port serial I/O board that boasts eight independent RS-232-compatible I/O ports with handshaking—all on a 50-pin board. It features DIP-switch selectable data rates for each port, extended address decoding for the SS-50C bus, and selectable interrupts. An on-board data-rate generator permits rates of up to 38.4 k bps. This board costs \$318.46, less cables. Complete details are available from Gimix Inc, 1337 W 37th Pl, Chicago IL 60609, (312) 927-5510.

Circle 454 on inquiry card

reservations, pay bills, exchange electronic mail, read an electronic newspaper, shop, and play video games. This conference will review videotext developments in Europe, Japan, and North and South America. Demonstrations of videotext systems will be given. Seminars on standards, legal aspects, and economic issues will be featured. Contact Videotex '81, 316 Lonsdale Rd, Suite 3, Toronto, Ontario, M4V 1X4, Canada, (416) 598-1981.

May 21-23

Annual Conference of the Educational Computing Organization of Ontario, Sheraton Centre and the Ontario Institute for Studies in Education, Toronto, Ontario, Canada. Exhibitions on the use of computers in schools and discussions on how to locate suitable educational materials will be featured. Contact the Conference Office, OISE, 252 Bloor St W, Toronto, Ontario, M5S 1V6, Canada.

June 1981

June 6-9

Atlanta Small Computer Show, Atlanta Hilton, Atlanta GA. Producers of small computers, peripherals, sup-

plies, and services will be exhibiting at this show. Business owners, corporate and government executives, data-processing managers, doctors, lawyers, and other professionals are expected to attend. Obtain additional information from The Atlanta Small Computer Show, 4060 Janice Dr, Suite C-1, East Point GA 30344, (404) 767-9798.

June 9-11

Understanding and Using Computer Graphics, Chicago IL. This seminar covers the latest in graphic-system technology, including hardware, software, and applications. Contact Bob Sanzo, Frost & Sullivan Inc, 106 Fulton St, New York NY 10038, (212) 233-1080.

June 14-18

The Second National Conference of the National Computer Graphics Association, Baltimore Convention Center, Baltimore MD. Computer-graphics demonstrations, exhibits, and workshops will be held. Contact the National Computer Graphics Association Inc, 2033 M Street NW, Suite 330, Washington DC 20036, (202) 466-5895.

June 16-18

NEPCON East '81, New York Coliseum, New York NY.

This exposition is aimed at engineers, prototype developers, production specialists and testing personnel. Technical programs will be presented. Contact Industrial & Scientific Conference Management Inc, 222 W Adams St, Chicago IL 60606, (312) 263-4866.

June 17-19

National Educational Computing Conference, North Texas State University, Denton TX. This conference will provide a forum for individuals and institutions interested in educational computing. Computer literacy, computer education for teachers, and computers in education are some of the topics to be covered. Contact Dr Jim Poirot, NECC-81 General Chairman, Computer Sciences Department, North Texas State University, Denton TX 76203.

June 20-22

The Fifth Annual Computerfest, Franklin University, Columbus OH. Talks on robots and calculators will be featured. Microcomputers and small-business systems will be presented. This show is being sponsored by the Midwest Affiliation of Computer Clubs and Franklin University. Contact Computerfest '81, Paul Pittenger, 215

Delhi Ave, Apt J, Columbus OH 43202, (614) 224-6237.

June 29-July 1

The Nineteenth Annual Meeting of the Association for Computational Linguistics, Stanford University, Stanford CA. Syntax, parsing, and sentence generation, computational semantics, discourse analysis and speech acts, speech analysis and synthesis, machine and machine-aided translation, and mathematical foundations of computational linguistics are some of the topics to be discussed. Contact Don Walker, Artificial Intelligence Center, SRI International, Menlo Park CA 94025, (415) 326-6200, ext 3071. ■

BYTE's Bits

Atari Slashes Prices

Atari Inc has reduced the price of the Atari 400 computer with 8 K bytes of memory to \$530. The 16 K expanded version of the 400 is now selling for \$630. Atari also reduced the Model 810 5¼-inch floppy-disk drive to \$599.95.

On another front, Atari plans to begin selling a \$150 word-processing program later this year. ■

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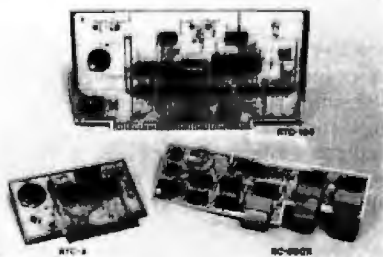
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What's New?

MISCELLANEOUS

Universal Peripheral Controller for the Z8000

Zilog's Z8090 Universal Peripheral Controller (Z-UPC) is designed for distributed processing and multitasking applications. The Z-UPC does arithmetic tasks, translation and formatting of data, and controls I/O (input/output) devices. It features 2 K bytes of internal ROM (read-only memory), externally expandable from 2 to 4 K. Also included is a 256-byte register file, three programmable 8-bit I/O ports, two counter/timers, and six levels of internal prioritized interrupts. The device is offered in four other versions, and all are priced at \$117.36 each, in sample quantities of 10 to 99. For additional details, contact Zilog, 10340 Bubb Rd, Cupertino CA 95014, (408) 446-4666.

Circle 443 on inquiry card

Atari 400 and 800 Screen Printer

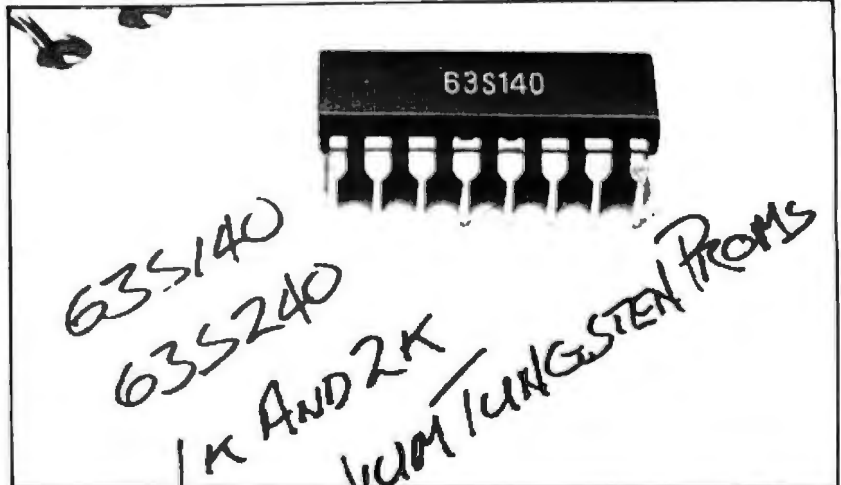
The Macrotronics screen-printer package enables users to print an Atari 400's or 800's screen display onto a Trendcom 200 or IDS 440G Paper Tiger printer. Text, graphs, and drawings can be printed, and the image can be printed in gray-scale, black-and-white, and reversed image. LPRINT and LIST"P:" commands are used to print. The package includes a connector assembly with a cable and a 3 K-byte auto-loading program on floppy disk and cassette. Listings of sample programs are included in the user's manual. The package is priced at \$139, from Macrotronics Inc, 1125 N Golden State Blvd, Suite G, Turlock CA 95380, (209) 667-2888.

Circle 444 on inquiry card

Novation Has LSI Modem Modules

These modem modules can operate at rates up to 1200 bps (bits per second) and are designed for building-block applications within computers or terminals. The modules can provide Bell 202 half-duplex, Bell 103 answer/originate, CCITT European Standards V.21 or V.23, ViewData European Network, and interface with the deaf teletypewriter (TTY) network. Contact Novation, 18664 Oxnard St, Tarzana CA 91356, (213) 996-5060.

Circle 445 on inquiry card



Extremely Fast Schottky PROMs

Using a titanium/tungsten technique, Monolithic Memories Inc has developed a series of fast Schottky 1 K- and 2 K-bit bipolar PROMs (programmable read-only memories). These devices use a programming technique that doesn't require a separate programming pin. Available in 256- by 4-bit, and 516- by 4-bit configurations, the PROMs feature PNP inputs for low-input current, full Schottky clamping, and three-state or open-collector outputs. They operate

at 45 ns for commercial and 55 ns for military devices. In lots of 100, each 63S140/1 commercial 1 K-bit PROM costs \$5; the military 53S140/1 is \$7.50. In similar quantities, the 2 K-bit PROMs are \$7.50 and \$11.25 each. Contact Monolithic Memories Inc, 1165 E Arques Ave, Sunnyvale CA 94086, (408) 739-3535.

Circle 446 on inquiry card

Fujitsu America's 8-Inch Winchester Disk Drives

The Model 2311 8-inch Winchester disk drive stores 48 megabytes and the Model 2312 84 megabytes; both feature a 20 ms access time. The 2311 uses two hard disks for storage, and the 2312 stores its 84 megabytes on four disks, utilizing 589 cylinders at 20 K bytes per track. An SMD interface with data-separation circuitry and internally selectable fixed- and variable-length sector formats are provided. The price of the 48-megabyte 2311 is \$3195 in OEM (original equipment manufacturer) quantities of 100, and the 84-megabyte 2312 drive is \$3795 in the same quantities. The Fujitsu Model 2301 floppy-disk drive stores 11.7 megabytes and is priced at \$1660 in OEM quantities of 100. The 2302 floppy-disk drive stores 23.4 megabytes and is priced at \$2095 in OEM quantities. For additional information, contact Fujitsu America Inc, 2945 Oakmead Village Ct, Santa Clara CA 95051, (408) 727-4300.

Circle 448 on inquiry card

TI Extended BASIC and Memory Expansion Unit

TI Extended BASIC is an expanded version of the resident BASIC in Texas Instruments' TI-99/4 microcomputer. It features ACCEPT AT and DISPLAY AT statements, sprites (programmable moving objects), subprograms, and error-handling functions. Multiple statements can be written on the same line with tail-end remarks. Complex IF...THEN...ELSE statements can also be written.

The Memory Expansion Unit is exclusively designed for use with Extended BASIC or UCSD Pascal, Version IV, which is newly available. The unit adds 32 K bytes of programable memory to the 16 K bytes resident in the TI-99/4. For more information, contact Texas Instruments Inc, Consumer Relations, POB 53, Lubbock TX 79408, (800) 858-4565; in Texas (800) 692-4279.

Circle 447 on inquiry card

BYTE'S ARCADE

Star Raiders

Gregg Williams, Senior Editor

What can you say about a game that takes your breath away? There are not enough superlatives to describe Star Raiders. Just as the VisiCalc software package from Personal Software has enticed many people into buying Apple II computers, I'm sure that the Star Raiders software cartridge from Atari Inc has sold its share of Atari 400 and 800 computers.

What is Star Raiders? It's a video arcade game that isn't hungry for quarters. I first saw Star Raiders at the West Coast Computer Faire in May 1979, and in the two years that have passed since the first public viewing of the game, no one—I repeat, no one—has created either a home-computer game or a coin-operated video game that is better than Star Raiders. (This fact is even more surprising when you consider the speed with which new standards are set in this industry.)

For the people who haven't seen Star Raiders in action, I'll attempt a brief description. Star Raiders is



Photo 1: The view from the bridge of the Star Raiders ship during a hyperspace jump. A static photo cannot do justice to the excitement you feel as stars streak by prior to the jump.

loosely modeled on the "Star Trek"-type game that has been running on micro- and larger computers for the past eight years. You, as commander of a starship, must search out and destroy all enemy spaceships in the galaxy (which is subdivided into a rectangular array of units called "sectors"). Of course you have only a certain amount of energy, and when you fight an enemy ship that is in the sector you occupy,

it can fight back and damage your ship.

Star Raiders is a descendant of this kind of game in the same way that the new pocket computers are descendants of a four-function mechanical adding machine. The many innovations in Star Raiders make you feel that you are actually piloting the spaceship instead of just typing in commands (and endlessly pressing the ubiquitous RETURN key).

Star Raiders has color, sound, and joystick input to make the game more realistic, but the feature that gives it life is its real-time animation. When you patrol a sector, you see a field of stars passing you in all directions, as if you were actually moving through a three-dimensional field of stars. When you steer the ship using your joystick, the stars outside your ship veer realistically in the opposite direction. Enemy ships (called Zylons) appear from above or below, receding in size as they speed past. A battle claxon sounds when you enter a sector containing enemy ships. Attacking Zylons shoot balls of energy at your ship; if they hit, your shields flicker and you hear a destructive crash. And the hyperspace effect (used to

Why spend all those quarters on arcade games? With a microcomputer and a few weeks' worth of arcade money, you can enjoy at home microcomputer games that are just as good as (and sometimes identical to) the popular coin-operated video arcade games. BYTE's Arcade is an occasional feature that reviews the best of these fast-action games. If you would like to review or give an opinion of a favorite microcomputer game of this type, please write to: BYTE's Arcade Editor, POB 372, Hancock NH 03449.



Photo 2: The Star Raiders Galactic Chart. Each square represents a sector of space. The star symbols represent sectors containing starbases; all other squares marked with symbols represent sectors containing Zylon enemy ships. Your ship is located in the square near the center, marked by a small dot.



Photo 3: The view from the bridge during combat. "Star Trek" games were never like this! When you occupy the same sector as enemy ships (here, top and bottom center) their size will increase and decrease as you move toward or away from them.

At a Glance

Name
Star Raiders

Author
Doug Neubauer

Type
Arcade-style game

Format
Game cartridge

Manufacturer
Atari Inc
Consumer Division
1195 Borregas Ave
Sunnyvale CA 94086
(408) 745-2000

Language
6502 machine language

Computer
Atari 400 or 800

Price
\$59.95

Documentation
10 pages, 22 by 28 cm
(8½ by 11 inches)

move you from one sector to another) must be seen to be believed!

I could continue to describe the intricacies of Star Raiders, but words cannot evoke the sensation of actually playing the game. To Doug Neubauer of Atari, who wrote Star Raiders, my unbounded thanks. To all software vendors, this is the game you have to surpass to get our attention. And to Atari, I can only say that if you offer us games like this, we can't refuse. ■

Super Nova

Bob Liddil, POB 66, Peterborough NH 03458

Arcade video games are extremely popular throughout the world. It would seem natural, therefore, that these games would take hold in the TRS-80 marketplace, where good graphics programs are in short supply. There is, to be sure, a good deal of mediocrity on the market, such as

early versions of Space Invaders. Super Nova, however, is an example of how well a program can be created if its designer takes enough time and care with it.

The instant the program (a standard machine-language system tape) is loaded, Super Nova spins into a stunning

What's New?

SOFTWARE

Two New Products from Commodore

Ozz—The Information Wizard lets users design data-management and retrieval systems. Ozz was created for the Commodore CBM 8032 microcomputer. The program allows users to set up formats, store information, perform calculations and global searches, design forms and documents, analyze information, and access files.

Wordcraft 80 is a word-processing program designed for the 8032 system. Wordcraft 80 offers variable page layouts of up to 117 characters by 98 lines; screen display of finished-format documents; tabs, indentations, decimal tabs, columns; automatic centering and right-margin justification; automatic pagination, headers, and trailers; deletion and insertion of text; transfer of text from one page to another; merging of form letters with name-address files; handling of single sheets or continuous-form paper; sub- and superscripts; and automatic underlining and emboldening of text.

For more information on both products, contact Commodore Business Machines Inc. 950 Rittenhouse Rd, Norristown PA 19403, (215) 666-7950.

Circle 509 on inquiry card.

Atari Graphic Editor

Plot & Draw is a cassette-based graphics-generation and editing package that creates graphics in three colors plus a background. Video drawings can be created and saved on cassette. It requires an Atari computer with 8 K bytes of programmable memory and a joystick. The price is \$18 from Mosaic Electronics, POB 748, Oregon City OR 97045.

Circle 510 on inquiry card.

The Voice

The Voice gives the Apple II or the Apple II Plus the power of speech. The Voice's built-in vocabulary allows expression of many combinations of phrases, or the user can enter his own vocabulary and make the 48 K-byte Apple say anything. Floppy disks store up to 80 words or phrases that can later be sorted for quick reference. The Voice allows any BASIC program to speak by using PRINT statements. The price is \$39.95, from Muse Software, 330 N Charles St, Baltimore MD 21201, (301) 659-7212.

Circle 511 on inquiry card.

FORTH-79 for the Apple

MicroMotion's FORTH-79 conforms to the International FORTH-79 standard. It is suited for data acquisition, process control, animation, and video games.

FORTH-79 comes with a screen editor and macroassembler, and vocabularies for strings, double-precision integers, low-resolution graphics, and modem communications. The operating system allows for multiple disk drives and is 13- or 16-sector disk compatible. It runs on a 48 K-byte Apple II or Apple II Plus. FORTH-79 can be obtained for \$89.95 from MicroMotion 12077 Wilshire Blvd, Suite 506, Los Angeles CA 90025, (213) 821-4340.

Circle 512 on inquiry card.

TFORTH

TFORTH is a fig- (FORTH Interest Group) standard version of FORTH, extended for the TRS-80. It contains an operating system, assembler, text editor, floating-point mathematics package, I/O (input/output) package, graphics links into

A Stellar Trek

This high-resolution color version of the Star Trek game runs on the Apple II. Three different Klingon opponents and the Romulan Star Empire are pitted against the user. Users have many command prerogatives, including movement throughout the galaxy, use of starship weaponry, maintenance of energy reserves, repair of damage, and more. A Stellar Trek requires 48 K bytes of memory and Applesoft BASIC in ROM (read-only memory). The price is \$24.95 on floppy disk. Contact Rainbow Computing, 9719 Reseda Blvd, Northridge CA 91324, (213) 349-5560.

Circle 513 on inquiry card.

Combine Hard Disks and the TRS-80

HDOS-2 is a hard-disk operating system designed to be used with TRSDOS 1.2 on the TRS-80 Model II. The advantage of this software is that it allows a Corvus hard-disk drive to be interfaced with existing software with only minor changes to the programs. HDOS-2 requires 1 K bytes of memory and allows use of multiple drives. The system costs \$125. Contact Computer Program Associates, 15076 Beltway Dr, Dallas TX 75234, (214) 233-2039.

Circle 514 on inquiry card.

TRS-80 BASIC, and a phoneme assembler to support voice synthesizers. TFORTH is supplied on 5-inch floppy disks for \$130. Contact Advanced Technology Corporation, 1617 Euclid Ave, Knoxville TN 37921, (615) 525-1632.

Circle 515 on inquiry card.

What's New?

SOFTWARE

Link the TRS-80 with Other Systems

The Super-Host program allows any type of system to communicate with the TRS-80 Model I microcomputer. The program will configure itself to run under TRSDOS, NEWDOS 2.1, or NEWDOS-80. It keeps track of the date and time, even after reboot or system resets. One function of the program protects the user's own and any foreign system from unwanted control codes. Another feature allows users to customize transmissions to conform to other systems' standards and block out characters that might affect those systems.

Super-Host is a menu-driven program, so users can set up all system parameters. Other features are its lowercase driver, uppercase lock for incoming data, and independent uppercase lock on outgoing data. It has user-programmable nulls and line feed. TRS-80 computers with a printer can be programmed to maintain a printed record of callers who have accessed the system.

Super-Host is available for \$29.95 from Programs Unlimited, POB 265, Jericho NY 11753, (516) 997-8668.

Circle 516 on inquiry card.

FORTH for Atari

This FORTH system for the Atari 400 and 800 computers requires a minimum of 16 K bytes of programmable memory. The disk-based system has a screen editor and the capability to review and modify disk contents. Included with the program package is dictionary documentation and a customization guide. The system costs \$50. For further information, contact Pink Noise Studios, 1411 Center St, Oakland CA 94607, (415) 465-1212.

Circle 517 on inquiry card.

Softstuff Software from Heath



Heath's utility and applications programs in the Softstuff line include the General Ledger II on a floppy disk for use with the HDOS operating system or Heath's version of the CP/M operating system. The price for the program is \$124.95. The Small Business In-

ventory program for HDOS systems is \$69.95. The CBASIC language, a disk-based, noninteractive language with pseudocode compiler and run-time interpreter for CP/M systems is priced at \$110. The BDS C compiler includes a linking loader, a library containing file I/O (input/output) and floating-point functions, and a library manager. The C compiler runs on CP/M systems and is priced at \$119.95.

The Softstuff product line also offers the Microsoft MACRO-80 package, a full-screen editor, a sort program, and a network system. For more information on Softstuff programs, contact Heath Company, Department 350-670, Benton Harbor MI 49022, (616) 982-3210.

Circle 518 on inquiry card.

Software for Law Offices

Law-1 is a time-management and billing system for the legal professional. It features system and program security, client/matter and attorney reporting, accounts-receivable ledgers, ageing analysis, pre-billing worksheets, invoicing, and automatic file backup, and it performs other-than-standard inquiries.

Law-1 is written in CBASIC for CP/M-based systems. It comprises 38 applications packages. The system is parameter driven and can support floppy- and hard-disk configurations. Different terminals are supported. A demonstration package is available for \$75, and the single-user package price is \$800. For further information, contact Microcon Inc, POB 805, Amherst NH 03031, (603) 673-0230.

Circle 519 on inquiry card.

Learn Trigonometry on the Compucolor II

Using a circular functions approach to trigonometry, these teaching programs provide experiences with radian measure, sine function development, graphing the sums of functions, drill with identities, and polar graphs. All programs encourage the user to explore functions under computer guidance, to recognize identities, and to notice patterns. Program listings are included, so users can create additional variations and drills. This disk for the Compucolor or Intecolor computers requires a 64- by 32-character screen with 127 by 127 color blocks in low- and high-resolution graphics. It is available for \$29.95 from Metra Instruments Inc, 2056 Bering Dr, San Jose CA 95131, (408) 297-8530.

Circle 520 on inquiry card.

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Hardware Review

RAMCRAM Memory Module for the Atari

Mark Pelczarski
1206 Kings Circle
West Chicago IL 60185

Axlon Inc has released an alternative for add-on memory for the Atari computers that might save some money for Atari 800 owners. RAMCRAM will also offer more memory for the Atari 400 than you may have thought possible.

For \$320 you can buy a single module that contains 32 K bytes of programmable memory. The unit plugs into the middle memory slot of an Atari 800, and with the 16 K-byte module provided with your system, gives a full 48 K bytes of memory (it will not work with only an 8 K-byte module ahead of it).

In an Atari 400, the module can replace the built-in 8 K bytes of memory to give a 32 K-byte system. The Atari 400 would then be able to use any software for Atari 800 32 K-byte systems, plus it would contain enough memory to handle a DOS (disk operating system) and, therefore, a floppy-disk drive. With RAMCRAM, Personal Software's 17 K-byte VisiCalc will run on the Atari 400.

In an Atari 800, the top 8 K bytes of memory-address space are pre-empted if you have a cartridge in the left slot, such as BASIC, the Editor/Assembler, or Star Raiders. With a left cartridge installed you can use



Photo 1: The Axlon RAMCRAM memory cartridge for the Atari 400 or 800.

only 40 K bytes. Without a cartridge, but with RAMCRAM installed, you have 48 K bytes of memory which can be used for copying disks faster on a one-drive system. (DOS does not require a cartridge, and more programmable memory means swapping disks fewer times while copying.) You also have 48 K bytes for machine-language programs that do not need cartridges, such as VisiCalc, and languages could be loaded from disk without using cartridges.

Axlon also provides its dealers with a memory-diagnostic program that will analyze the memory of an Atari

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The VP-3301 can be used with a 525-line color or monochrome monitor or a standard TV set through an RF modulator.** It serves a wide variety of industrial, educational, business and individual applications including communication with time sharing and data base networks such as those provided by Dow Jones News/Retrieval Service, CompuServe and Source.

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Circle 313 on inquiry card.

800, checking that the full 48 K bytes are functional. It performs three tests: the first tries to zero every bit in memory, the second checks for memory uniqueness by turning on bits and testing whether other bits were affected, and the third rolls a 1 bit through each location, checking that every bit can be turned on. The diagnostic program is available to customers for \$15.

If you own an Atari computer and you're the type of person that thinks ahead more than a year, it seems as though RAMCRAM is the way to go for memory expansion. If you own an Atari 400, it gives you memory that you couldn't get otherwise. If you own an Atari 800, it gives you all the memory it can now hold and leaves one expansion slot open for future use. Given Axlon's plans for additional Atari-compatible products, that slot may be valuable. ■

At a Glance

Name
RAMCRAM

Use
Increases programmable-memory capacity of Atari computers

Manufacturer
Axlon Inc
170 Wolfe Rd
Sunnyvale CA 94086
(408) 730-0216

Dimensions
7.5 by 15.5 by 1.5 cm (3 by 6 by 5/8 inches)

Price
\$320

Features
Expands Atari 800 to 48 K bytes, replaces existing memory in Atari 400 to give a total of 32 K bytes

Hardware needed
Atari 800 computer with 16 K bytes of programmable memory, or any Atari 400 computer

*Model VP-3303 with built-in RF modulator—\$389.

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Education Forum

Another series of programs can be composed to help students learn to discriminate between objectively, rationally, and intuitively derived conclusions. The aim is to develop discernment in the student and provide the time and practice necessary for one to become adept at applying such thinking skills.

Interdisciplinary perspectives can be the theme of still another thinking-model program. Here, the goal is to arrive at the most plausible explanation for something by considering information from various disciplines. For example, students examine explanations based on economic influences, historical factors, or any other perspectives that are appropriate to the subject being considered.

Such a program, in addition to the ones mentioned above, can be designed for educational levels ranging from junior high school through college. (Anyone interested in more information regarding the programs discussed in this article can write the author in care of the Music Department, James Madison University, Harrisonburg VA 22807.)

With thinking skills heightened, we are now ready to pursue the second most important aspect of integrative education, concept development. Concept development often utilizes basic rules and principles, many of which have several exceptions. The idea is for the students to find the exceptions and be able to adapt the principles to suit varying circumstances. To illustrate this, let us compare the steps of an information-oriented approach to a concept-oriented one.

The information-oriented approach is basically an inductive one. That is, we begin by giving out specific facts and data, then we draw conclusions, and finally derive our concepts. (Unfortunately, many teachers today never follow through to the final step of deriving the basic concept!) A concept-oriented approach is deductive rather than inductive. After prerequisite definitions are given, students are taught a generalized concept. From there, students speculate on probable conclusions and hypotheses, then search out the necessary information in an effort to test the conclusions. What the deductive, concept-oriented approach develops is the ability to apply a general concept, and the skills to resourcefully and efficiently locate the information needed to test one's speculative conclusions. To accelerate, simplify, and reinforce this process, the needed information could be made available through a computer retrieval system.

Let us consider how this method can be employed within a discipline through the use of the microcomputer. The following example pertains to basic music theory. The prerequisite information required of the student are knowledge of the definition and labeling of music intervals, the definition of a triad, and how to read treble clef.

Computer: Now I am going to show you how to derive various types of triads by teaching you a simple harmonic concept. This concept is:
"Triads are built with intervals."

Technical Forum

Multiple programs can also run under an interrupting, time-sharing system. Each program may be assigned a certain percentage of the total processing time. A timed interrupt and executive routine are used to rotate the processor between programs. The executive program, from which the interrupt branches, acts as a "traffic cop" to give each program its fair share of time.

Multilevel Interruption

A computer system generally has

several interrupting devices. To sort out these interrupts a priority scheme is generally used. The priority scheme assigns each device in the system a priority level, according to its importance. This allows the most important I/O devices to be serviced before those of lower priority. Except in the simplest interrupt implementations, a higher-level interrupt is allowed to interrupt the current routine of a lower-priority interrupt. In this way, several interrupt routines could conceivably be nested in a busy system.

Most microprocessors have only one general-purpose interrupt input, and external hardware must be used to resolve priorities between the various interrupt lines. The hardware may also provide for additional functions, such as individually selectable interrupt levels and nesting of interrupts. The hardware involved in a very simple interrupt system is shown in figure 1a. In this system, once an interrupt occurs, the interrupt system should remain disabled until completion of the interrupt routine. With this very simple implementation a high-level interrupt may not interrupt a lower-level routine once it is in progress.

For an interrupt to be recognized by the microprocessor an *enable interrupts* instruction must have been previously executed by the program. Additionally, some devices will require that a special interrupt register be set with the proper vectoring data. When an interrupt is recognized, the contents of the program counter will be pushed onto the stack, and the start address of the interrupt routine will replace the old program-counter data.

When an interrupt occurs, the return address is saved on the stack, and the processor branches unconditionally to the interrupt routine. The microprocessor will also disable its internal interrupt system whenever an interrupt occurs. Software must enable interrupts again before other interrupts will be recognized by the device.

An interrupt routine should also do some housekeeping to insure a successful return to the interrupted program. First, the contents of all the registers should be saved so that their contents can be restored prior to resuming the interrupted program. Depending upon your hardware, you may need to output the priority level of the current interrupt for comparison with incoming interrupts.

In the case of serial devices, such as terminals or cassette decks, the microprocessor is usually interfacing with a UART (universal asynchronous receiver-transmitter). These devices have signals indicating "receiver ready" and "transmitter ready" to assert interrupt lines. The signals can be used as independent interrupts (one per device) or can

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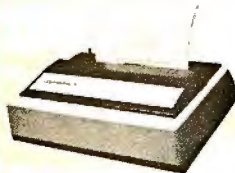
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Software Received

This is a list of software packages that have been received by BYTE Publications during the past month. The list is correct to the best of our knowledge, but it is not meant to be a full description of the product or the forms in which the product is available. In particular, some packages may be sold for several machines or in both cassette and floppy-disk format; the product listed here is the version received by BYTE Publications.

This is an all-inclusive list that makes no comment on the quality or usefulness of the software listed. We regret that we cannot review every software package we receive. Instead, this list is meant to be a monthly acknowledgment of these packages and the companies that sent them. All software received is considered to be on loan to BYTE and is returned to the manufacturer after a set period of time. Companies sending software packages should be sure to include the list price of the packages and (where appropriate) the alternate forms in which they are available.

Apple

Address Book, name and address file and telephone dialer for the Apple II. Floppy disk, \$49.95. Muse Software Company, 330 N Charles St, Baltimore MD 21201.

Data Fixer, disk software-repair utility for the Apple II. Floppy disk, \$29.95. Image Computer Products, 615 Academy Dr, Northbrook IL

60062.

Data Plot, on-screen data-graphing program for the Apple II. Floppy disk, \$59.95. Muse Software Company, (see above).

Invasion Force, graphics game for the Apple II. Cassette, \$19.95. Compu-Things, 708 Broadway, Chelsea MA 02150.

Monitor Extender, machine-language utility for the

Apple II. Cassette, \$19.95. Image Computer Products (see above).

Spelling, three educational games for the Apple II. Floppy disk, \$21.95. Software by Witzel, POB 2123, Littleton CO 80161.

Super Bar and Wine Guide, wine selection guide and bar recipe program for the Apple II. Floppy disk, \$24.95. Cine-Aero Productions, 1821 N Frederic St, Burbank CA 91505.

Super Text Form Letter Module, add-on module to Super Text II word-processing package for the Apple II. Floppy disk, \$100. Muse Software Company (see above).

Super Text II, word processor for the Apple II. Floppy disk, \$150. Muse Software Company (see above).

Atari

Shuttle Ascent Simulation, space-shuttle simulation for the Atari 800. Cassette, \$9.95. Starbound Software, POB 214, Cocoa Beach FL 32931.

Commodore

Addition, educational program for the Commodore PET. Cassette, \$20. Teaching Tools, POB 12679, Research Triangle Park NC 27709.

Create-A-Base, data-base management program for the Commodore CBM. Floppy disk, \$360. Micro Computer Industries Ltd, 1520 E Mulberry, Fort Collins CO 80524.

Subtraction, educational program for the Commodore PET. Cassette, \$20. Teaching Tools (see above).

Exidy

Toolkit, screen editor and enhancements for the Exidy Sorcerer. Cassette, \$69.95. North American Software, POB 1173 Station B, Downsview, Ontario, M3H 5V6, Canada.

Sword, word processor for the Exidy Sorcerer. Cassette, \$34.95. North American Software (see above).

Super Graphic Scratch Pad Version 2.2, graphics utilities for the Exidy Sorcerer. Cassette, \$24.95. North American Software (see above).

Radio Shack

Aviation, aviation-calculation package for the TRS-80 Pocket Computer. Cassette, \$24.95. Radio Shack, 1 Tandy Ctr, Fort Worth TX 76102.

Cheaptalk, voice-output routines for the TRS-80 Model I. Cassette, \$19.95. Alan Saville, POB 5190, San Diego CA 92105.

Income Property Analysis System, business-analysis program for the TRS-80 Model I or III. Floppy disk, \$225. Advanced Business Microsystems, 5801 Marvin D Love Fwy, #103, Dallas TX 75237.

LDOS, disk operating system for the TRS-80 Model I. Floppy disk, \$149. Galactic Software Ltd, 11520 N Port Washington Rd, Mequon WI 53092.

Olympic Decathlon, multi-player graphics game for the TRS-80 Model I. Floppy disk, \$24.95. Microsoft Consumer Products, 400 108th Ave NE, Suite 200, Bellevue WA 98004.

RSM Patch, modification package to Small Systems Software's RSM for the TRS-80 Model III. Cassette, \$9.95. Remarkable Software, POB 1192, Muskegon MI 49443.

SECS, full-screen editor for the TRS-80 Color Computer. Cassette, \$29.95. Datasoft Inc, 16600 Schoenborn St, Sepulveda CA 91343.

SIGMON, machine-language monitor for the TRS-80 Color Computer. Cassette, \$29.95. Datasoft Inc (see above). ■

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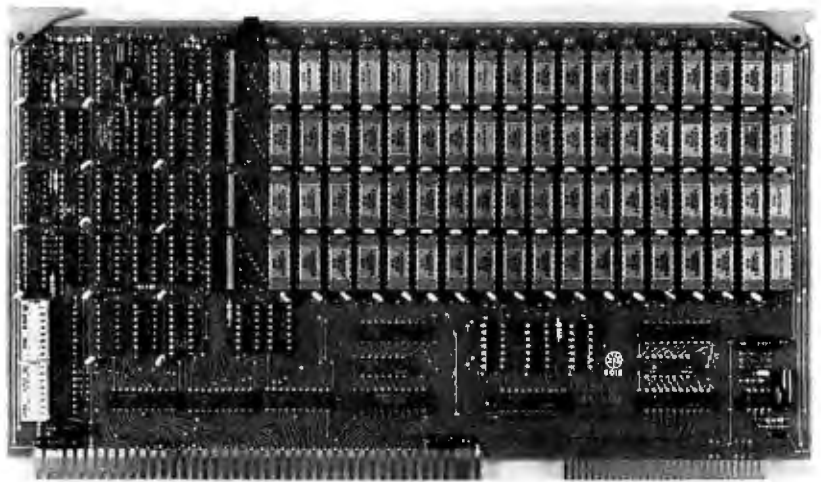
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MISCELLANEOUS

Memory Board for the SBC 86/12A

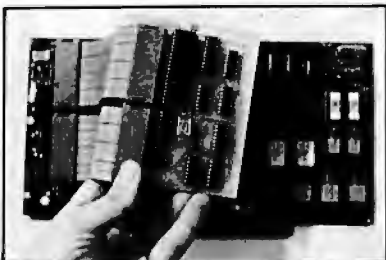
The CI-8086 memory board is designed for Intel's Intellec SBC 86/12A microcomputer. Available with 32 K to 512 K bytes on a single board (depending on what memory components are used), the module is compatible with 8- and 16-bit Multibus-based systems. The CI-8086 generates and checks even parity with selectable interrupt on parity error. It features a 250 ns data-access time and a 375 ns cycle time. The memory is addressable in 16 K-byte increments up to a total of 16 megabytes of memory. Power consumption is under 8 W. The price is \$1500 for the 128 K-byte



board and \$4700 for the 512 K-byte module. The CI-8086 is available from Chrislin Industries Inc, 31352 Via Colinas, #102,

Westlake Village CA 91361, (213) 991-2254.

Circle 561 on inquiry card.



Replace an 8080 with an 8085

A 50 to 250% throughput increase can be achieved with the Series II Microprocessor Enhancement Modules. These modules perform 8080A in-circuit emulation using a code-compatible 8085A-2 microprocessor. Installation requires less than five minutes, involving only the replacement of the system 8080A processor and status latch with connectors. The modules are offered for most 8080A products at \$350 in OEM (original equipment manufacturer) quantities. An Evaluation Design Pack is available for \$500. Contact Paragon Systems Inc, POB 2050, Corvallis OR 97330, (503) 758-1029.

Circle 562 on inquiry card.

12-Bit CMOS Converters

The DAC1218 and the DAC1219 are 12-bit CMOS (complementary metal-oxide semiconductor), 4-quadrant, multiplying, D/A (digital-to-analog) converters. The devices offer 12-bit monotonicity, maximum differential linearity error of ± 0.5 LSB (least significant bit), and feature a design technique resulting in TTL (transistor-transistor logic) compatibility. Power-supply voltages can range from +5 to +15 V; typical power consumption is 20 mW. The DAC1218 has a maximum linearity error specification of 0.012%, and the DAC1219 is rated at 0.024%.

In OEM quantities of 100, the DAC1218 sells for \$10.75 each, and the DAC1219 is priced at \$9.75 each. For additional information, contact National Semiconductor Corporation, 2900 Semiconductor Dr, Santa Clara CA 95051, (408) 737-5000.

Circle 563 on inquiry card.

Expand Atari's Memory

The RAMCRAM memory modules can expand the Atari 400's memory to 32 K bytes and the Atari 800's to 48 K. RAMCRAM plugs into the Atari internal memory-module slot, replacing the Atari's module. Each RAMCRAM module contains 32 K bytes of programmable memory. The suggested retail price is \$320.

An 8-slot bus-expansion board for the Atari and Apple microcomputers, with power supply, controller, and software, is available for further memory expansion. This memory-board bus can hold up to eight RAMCRAMs, offering 256 K bytes of programmable memory. Its suggested retail price is \$850.

For further details on both of these devices, contact Axlon Inc, 170 N Wolf Rd, Sunnyvale CA 94086, (408) 730-0216.

Circle 564 on inquiry card.

The Atari Assembler/Editor

Mark Pelczarski
1206 Kings Circle
West Chicago IL 60185

The Atari Assembler/Editor plug-in ROM (read-only memory) cartridge is finally available. Anyone who plans to use or learn 6502 assembly language on the Atari 400 or 800 computers will find it a convenient tool. It is especially nice for beginners, since some of the editing and programming features of Atari BASIC are available. The Atari people point out that this assembler is not designed for professional programmers, although they do use it for much of their in-house programming. They describe it as an experimenter's assembler designed for those people writing machine-language subroutines to supplement their BASIC programs when speed, sound, or graphics are factors.

Overview

The Assembler/Editor package includes the cartridge and a user's manual. The cartridge actually contains three programs: the Writer/Editor, the Assembler, and the Debugger/Mini-Assembler. The cartridge will operate with either a cassette-tape drive or a floppy-disk system, but the disk gives more versatility. The cartridge plugs into the left slot in the Atari 800, and it occupies the

upper 8 K bytes of user-accessible memory-address space.

Although it does not make any attempt to teach the fundamental concepts of assembly-language programming, the manual does include an overview of 6502 assembly language (command format, addressing modes, types of operands, etc)—something I've not seen in other assembler/editor packages. The beginner will still want to find a good book about 6502 assembly language, however. A large part of the manual contains information explaining the use of each program and the options and procedures available. It seems complete and easy to follow and contains helpful information in the appendices, including sample programs showing how to use machine-language subroutines from BASIC.

This assembler will be used mostly for writing short subroutines that will be called from BASIC programs. Those who decide to write straight machine-language code will need more information about the Atari I/O (input/output) structure, which may be found in the *Atari Technical Manual*, now available. They will also have to consider the memory capacity of their machine. Atari estimates that the amount of object code that can be "comfortably developed" with the cartridge is about one-tenth of the memory space available. Thus a 40 K-byte system would allow about 4 K bytes of object code to be developed. (Remember that other use of the top 8 K bytes is precluded by the cartridge, so 40 K bytes is the maximum.)

Those who want to write long machine-language segments to attach to BASIC programs may find some other problems. There are only 256 bytes in memory that are guaranteed untouched by BASIC or the operating system. If you want to write a longer machine-language routine, you must incorporate it into the actual BASIC program through the use of strings. This is not an unknown practice. Programmers of Radio Shack's TRS-80 have been using this method for quite some time. The only drawback is that the code must be fully relocatable. That means the subroutine can have no JMP or JSR commands to itself, and no data tables. Some non-relocatable material may be put in the one 256-byte block that is always available, but some headaches may persist. These procedures are well documented in the appendix,

At a Glance

Product Atari Assembler/Editor Cartridge	16 K bytes of memory recommended, but not necessary
Manufacturer Atari Inc, Computer Products Division 1346 Bordeaux Dr Sunnyvale CA 94086	Documentation User's manual describing operating features is included. Atari technical information and 6502 assembly-language programming information available separately
Price \$59.95	Audience Those who want to write machine-language programs and subroutines on the Atari computers
Format Plug-in ROM cartridge	
Computer requirements Atari 400 or 800, floppy- disk drive, and more than	

by the way, with sample programs using calculations, sound, and graphics (a demonstration of putting 128 colors on the screen at once).

Writer/Editor

The Writer/Editor allows you to enter and edit assembly-language programs. Each line of a program is numbered, as in BASIC, and contains an optional label, an instruction, an operand, and an optional comment. These are located in predesignated fields across the line, and pressing either Tab or the space bar moves the cursor to the next field. The Editor also uses the same screen editing that Atari BASIC uses: you may move the cursor to a line, insert, delete, or change characters, then press Return and the new line is entered. The line numbering allows other BASIC-like commands, such as:

- LIST—to list all or part of a program
- DEL—to delete a line or a range of lines
- NUM—for automatic line numbering
- REN—to renumber lines

(Strangely, most of these were left out of Atari BASIC.) The Editor also has FIND and REPLACE commands, plus SAVE and LOAD commands that let you move parts of programs, allowing you to create your own library of subroutines on disk.

The Assembler

The Writer/Editor puts your program into a text buffer in memory. The Assembler takes the source program from the buffer, or from disk or cassette tape, and assembles it into an object program (true 6502 machine language) stored in a specified range of memory, on disk, or on tape. During assembly you can also specify an assembly listing to be displayed on the screen, written to disk or tape, or printed on a printer. Assembly requires two passes, which is standard. Directives to the assembler may be included in your program to control paging and titles in the assembly listing, and to insert values and character strings into the machine code. One feature not provided that would have been helpful is a symbol table that shows the values assigned to labels you've used.

Debugger/Mini-Assembler

The Debugger allows you to trace through your program step by step as it runs and make minor changes in conditions or in the code. Options provided allow for single-stepping through your program, displaying and changing register or memory values, and moving and comparing contents of memory locations. There is also the Disassembler, which will display the instruction mnemonics for any range of memory, and the Mini-Assembler, which lets you assemble single lines of code at specified locations.

Conclusions

Although there are three programs in the cartridge, transferring control back and forth between them is simple, thus creating the effect of a nicely integrated system. When you turn the power on, you are in the Editor mode. Typing ASM assembles whatever source code is in the buffer and returns you to the Editor. Typing BUG puts you in the Debugger. Typing X returns you to the Editor again. With a disk, typing DOS gives you access to the disk operating system, and you can access the Atari's built-in Memo-Pad by typing BYE.

There's nothing easier than using a cartridge-based system, even if we did have to wait for it. The designers of the Assembler/Editor programs have taken advantage of the cartridge system, and have made a nice, easy-to-use tool for both beginners and assembly-language experts. It was not designed for large-scale machine-language code development, but that shouldn't bother most people. It is much easier to write the bulk of a program in a higher-level language such as BASIC, leaving machine language for the subroutines that have requirements BASIC cannot satisfy. ■

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The Atari Technical Manual is available from Atari for \$27 plus \$3 shipping. A documented operating-system source-code listing is also available for \$17 plus \$3 shipping. Contact Atari Inc., Customer Service Division, 1346 Bordeaux Dr., Sunnyvale CA 94086.

What's New?

SOFTWARE

Ultrасort Gives CP/M Users Fast Sorts

Ultrасort II is an 8080 and Z80 machine-language program that allows CP/M and CBASIC2 users to sort, merge, or select records from data files, or to find the number of logical records in a file. It can be used as a stand-alone utility or as a subroutine called from CBASIC2. Ultrасort II sorts on up to five keys, and fields can have a fixed or a variable length. Strings can optionally be floated as numeric fields; numeric fields are automatically floated. A select capability permits either omitting or including records that are less than, equal to, or greater than up to four independent select keys. Ultrасort II is available from Computer Control Systems Inc., 298 21st Ter SE, Largo FL 33541.

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Letter Perfect for the Atari

Letter Perfect is a word-processing package for the Atari 800. It features proportional spacing, page numbering, headers, footers, and underlining. Embedded commands in text for expanded, normal, and condensed print are possible. The program is menu-driven. The user can change drive numbers; edit, load, save, merge, print, lock and unlock, and delete files; format disks; and perform a data-base merge for mailings. Printing and screen formats are program-mable. Text block moves, scrolling forward and backward, scrolling speed, search, tabbing, and character and line insertion and deletion are among its features. Letter Perfect is available for \$150 from LJK Enterprise Inc., POB 10827, St Louis MO 63129, (314) 846-6124.

Circle 517 on Inquiry card.

Tiny Pascal Plus+ for PET and Apple II

Tiny Pascal Plus+ is an enhanced version of Tiny Pascal with support for graphics. The package runs on 32 K-byte PET and Apple microcomputers. This Pascal includes a line editor, compiler, interpreter, and numerous structured programming commands. GRAPHICS, PLOT, POINT, TEXT, INKEY, ABS, and SQR are among the other command functions.

Tiny Pascal for the PET supports double-density plotting, giving 80 by 50 plot positions. The Apple version supports low- and high-resolution graphics. Tiny Pascal on floppy disk costs \$50. The PET cassette version costs \$55. Nongraphics versions are \$35 on disk and \$40 on cassette. Contact Abacus Software, POB 7211, Grand Rapids MI 49510.

Circle 518 on Inquiry card.

Applegraph Your Business Charts

Applegraph is a software package for general-purpose data plotting in a variety of formats for the business, professional, and research decision maker. The program yields high-resolution, multi-color graphics for video display and hard-copy output. Display formats include pie charts, bar graphs, area plots, points, and solid or dashed lines, produced in any combination of overlays. Applegraph has simple commands that can be entered interactively or in advance. Data can be entered directly or supplied from other programs. Applegraph is available for \$200 from Business & Professional Software Inc., POB 11, Kendall Square Branch, 238 Main St, Cambridge MA 02142, (617) 491-3377.

Circle 519 on Inquiry card.

APL for the Apple

APL/V80 is now available for the Apple II. It requires the Microsoft SoftCard, CP/M, and a 24 by 80 video board. Another version is available that doesn't require the video card. APL/V80 includes APL arithmetic functions, Boolean and relational functions, selectional and structural functions, and nine general functions. The language has disk-based workspace and copy-object libraries, and supports arrays of up to eight dimensions. The software provides dynamic execution of system commands, canonical representation and function fix, and can use latent expression. APL/V80 allows booting directly into an application program from system power-on. A keyed ISAM (indexed-sequential access method) package, a text editor, and a check-management package are available as options for \$50 each.

APL/V80 costs \$500. It is available from Vanguard Systems Corporation, 6901 Blanco, San Antonio TX 78216, (512) 340-1978.

Circle 520 on Inquiry card.

FORTH for SWTPC Computers

FORTH is available for SWTPC computers with Percom disk drives. This FORTH, based on fig-FORTH, comes on a single-density 5-inch floppy disk and requires 16 K bytes of memory and a Percom disk drive with Mini-DOS. The disk contains the object code, a text editor, and assorted utilities. The manual contains a description of FORTH words, a tutorial, an explanation of the screen editor, and more. The package sells for \$24.95 from Greene Software, 6169 Fawn Meadow, Victor NY 14564.

Circle 521 on Inquiry card.

The Atari Tutorial

Part 1: The Display List

Chris Crawford
1272 Borregas Ave
Sunnyvale CA 94086

Editor's Note: Although I have always considered myself an "Apple person" (I have a disk-based Apple II at home), it was exciting to attend a two-day seminar for prospective Atari programmers given by Chris Crawford, Lane Winner, and Mike Ekberg, all of Atari Inc. Once I learned about the internal structure of the Atari 400 and 800 computers, I realized the tremendous potential these machines have.

We at BYTE are proud to present "The Atari Tutorial," a series of articles written by members of the Atari staff. The subjects include: the display list, graphics indirection and character sets, player-missile graphics, display-list interrupts, scrolling, and Atari BASIC. This series of articles is adapted from *De Re Atari*, a forthcoming book on the internal structure of Atari computers, to be published in December 1981 by Atari Inc.

This first article, which is on display lists, is by Chris Crawford, who with Lane Winner coauthored the article "An Introduction to Atari Graphics," which we published in the January 1981 BYTE, page 18. "The Atari Tutorial" will cover in greater detail many of the interesting points only mentioned in the first article. We hope you enjoy the series...GW

The Atari personal-computer system is a second-generation personal computer. First and foremost, it is a consumer computer. The entire thrust of its design is to make the consumer comfortable with the computer. This consumer orientation reveals itself in many ways. First, the consumer is protected from mistakes by items such as keystone-shaped connectors that cannot be inserted the wrong way, a power interlock that turns the computer off when internal electronics are exposed, and a pair of plastic shields protecting the system reset key. Second, the machine has a great deal of graphics power; people generally respond to pictures much more readily than to text. Third, the machine has good sound capabilities; again, people normally respond to

direct sensory input better than to indirect textual messages. Finally, the computer has joysticks and paddles for more direct tactile input than is possible with keyboards. The point is not that the Atari personal-computer system has a lot of features, but rather that the features are all part of a consistent design philosophy aimed at the consumer. The designer who does not appreciate this fundamental fact will be working against the grain of the system.

The internal layout of the Atari 400 and 800 computers (which are electrically equivalent to each other) is very different from that of other systems. They do have a microprocessor (a 6502), RAM (random-access read/write memory), ROM (read-only memory), and a PIA (peripheral interface adapter). However, they also have three special-purpose LSI (large-scale integration) devices known as ANTIC,

POKEY, and CTIA. These devices were designed by Atari engineers primarily to take much of the burden of housekeeping from the 6502, freeing the 6502 to concentrate on computations. While they were at it, they designed a great deal of power into these devices. Each is almost as big (in terms of silicon area) as a 6502, so the three of them together provide a tremendous amount of power. Mastering the Atari 400/800 is primarily a matter of mastering these three chips, a task we hope will be aided by this series of tutorial articles.

Principles of Television Display

In order to understand the graphics capabilities of the Atari personal-computer system, you must first understand the rudiments of how a television set works. Television sets use a *raster-scan display system*. An electron beam is generated at the rear of the television tube and shot toward the screen. Along the way, it passes between sets of horizontal and vertical coils or plates that, if energized, can deflect the beam to make it strike any point on the screen. The electronics inside the television set cause the beam to sweep across the screen in a regular fashion. The beam's intensity can be controlled: if you make the beam more intense, the spot being struck on the screen glows brightly; if you make it less intense, the spot glows dimly or not at all.

The beam starts at the top left corner of the screen and traces horizontally across the screen. As it sweeps across the screen, the changes in intensity paint an image on the screen. When the beam reaches the right edge of the screen, it is turned off, brought

This article appears in slightly different form in De Re Atari, a book published by Atari Inc, and is reproduced with its express permission.

back to the left side of the screen, and moved down a notch. It then turns back on and sweeps across the screen again. This process is repeated for 262 sweeps across the screen. (There actually are 525 sweeps across the screen in an alternating system known as *interlace*. I will ignore interlace and act as if the television has only 262 lines.) These 262 lines fill the screen from top to bottom. At the bottom of the screen (after the 262nd line is drawn), the electron beam is turned off and returned to the upper left corner of the screen. Then it starts the cycle over again. This entire cycle happens sixty times a second.

Now for some jargon: a single trace of the beam across the screen is called a *horizontal scan line*. A horizontal scan line is the fundamental unit of measurement of vertical distance on the screen. You state the height of an image by specifying the number of horizontal scan lines it spans. The period during which the beam returns from the right edge to the left edge is

called the *horizontal blank*. The period during which the beam returns from the bottom to the top of the screen is called the *vertical blank*. The entire process of drawing a screen takes 16,684 μ s. The vertical-blank period is about 1400 μ s. The horizontal blank takes 14 μ s, while a single horizontal scan line takes 64 μ s.

Most television sets are designed with *overscan*; they spread the image out so the edges of the picture are off the edge of the television tube. This guarantees that you have no unsightly borders in your picture. It is very bad for computers, though, because screen information that is off the edge of the picture does you no good. For this reason, the picture the computer puts out must be somewhat smaller than what the television can theoretically display. For this reason, only 192 horizontal scan lines are normally used by the Atari display. Thus, the normal limit of resolution of a television set used with the Atari 400/800 is 192 pixels (or picture

elements) vertically. (Of course, a color monitor can do much better than that.)

The standard unit of horizontal distance is the *color clock*. You specify the width of an image by stating how many color clocks wide it is. There are 228 color clocks in a single horizontal scan line, with a maximum of 176 actually visible. Thus, the ultimate limit for full color horizontal resolution with a standard color television is 176 pixels. With the computer, you can go even finer and control individual half-clocks. This gives a horizontal resolution of 352 pixels. However, use of this feature produces interesting color effects known as *color artifacts*. Color artifacts can be a nuisance if they are not desired; they can be a boon to the programmer who desires additional color and is not fazed by their restrictions.

Microcomputer Displays

The fundamental problem any microcomputer has in using a raster-scan television for display purposes is that the television display is a dynamic process. Because of this, the television does not remember the image. Consequently, the computer must remember the screen image and constantly send a signal to the television telling it what to display. This process of sending information to the television is a continuous process requiring full-time attention. For this reason, most microcomputers have special hardware circuits that handle the television. The basic arrangement is the same on virtually all systems:

microprocessor — screen RAM —
video hardware — TV screen

The microprocessor writes information to the screen RAM area that holds the screen data. The video hardware is constantly accessing this RAM area, getting screen data and converting them into television signals. These signals go to the television, which then displays the information. The screen memory is mapped onto the screen in the same order in which it is stored. That is, the first byte in the screen memory

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maps to the top left corner of the screen, the second byte maps one position to the right, then the third, the fourth, and so on to the last byte that is mapped to the lower right corner of the screen.

The quality of the image that gets to the screen depends on two factors: how sophisticated the video hardware is, and how much screen memory is used. The simplest arrangement is used by the Radio Shack TRS-80 and the Commodore PET. These machines allocate a specific 1 K bytes of RAM as screen memory. The video-hardware circuits simply pull data out of this area, interpret them as characters (using a character set in ROM), and put the resulting characters on the screen. Each byte represents one character, allowing a choice of 256 different characters in the character set. With 1 K bytes of screen RAM, 1024 characters can be displayed on the screen. There isn't much that can be done to modify this arrangement.

The Apple II, from Apple Computer Inc., uses more advanced video hardware. Three graphics modes are provided: text, low-resolution (lo-res) graphics, and high-resolution (hi-res) graphics. The text graphics mode operates much as the PET and TRS-80 displays operate. In the low-resolution graphics mode, the video hardware reaches into screen memory and interprets it differently. Instead of interpreting each byte as a character, each byte is interpreted as two blocks of color. The value of each block (4 bits) specifies the color of a single pixel. In the high-resolution graphics mode, each bit in screen memory is mapped to a single pixel. If the bit is on, the pixel gets color in it; if the bit is off, the pixel stays dark. The situation is complicated by a variety of design nuances in the Apple, but that is the basic idea.

The important point is that the Apple has three display modes—three completely different ways of interpreting the data in screen memory. The Apple video hardware is intelligent enough to interpret a screen-memory byte as either an 8-bit

character (text mode), two 4-bit color nybbles (low-resolution mode), or 7 individual bits for a bit map (high-resolution mode).

Atari 400/800 Display List

The Atari 400/800 display-list system represents a generalization of these systems. Where the PET and TRS-80 have one mode and the Apple has three modes, the Atari 400/800 has fourteen modes. A second important difference is that Atari 400/800 display modes can be mixed on the screen. You are not restricted to a choice between a screen full of text or a screen full of graphics. Any collection of the fourteen Atari graphics modes can be displayed on the screen simultaneously. The third important difference is that the Atari 400/800 screen RAM can be located *anywhere* in the address space of the computer and moved around while the program is running, whereas the other machines use fixed-screen memory areas.

This generality is made possible by a video microprocessor called ANTIC. Where earlier systems used rather simple video circuitry, Atari designed a full-scale microprocessor just to handle the intricacies of the television display. ANTIC is a true microprocessor—it has an instruction set, a program, and data. The program for ANTIC is called the *display list*. The display list specifies three things: where the screen data can be found, what display modes to use to interpret the screen data, and what special display options (if any) should be implemented.

When using the display list, it is important to shed the old view of a screen as a homogeneous image in a single mode and see it instead as a stack of *mode lines*. A mode line is a collection of horizontal scan lines. It stretches horizontally all the way across the screen. An Atari graphics 2 mode line is 16 horizontal scan lines high, while a graphics 7 mode line is only 2 scan lines high. Many graphics modes available from BASIC are homogeneous; an entire screen of a single mode is set up. But you must not limit your imagination to this pat-

Value of Bit Pair Binary	Decimal	Atari Color Register Used
00	0	COLBAK
01	1	COLPF0
10	2	COLPF1
11	3	COLPF2

Table 1: Atari color-register assignment in four-color map mode.

tern; with the display list, you can create any sequence of mode lines down the screen. The display list is a

collection of code bytes that specify that sequence.

ANTIC's Instruction Set

ANTIC's instruction set is rather simple. There are four classes of instructions: map-mode instructions, character-mode instructions, blank-line instructions, and jump instructions. Map-mode instructions cause ANTIC to display a mode line with simple colored pixels (no characters). Character-mode instructions cause ANTIC to display a mode line with characters in it. Blank-line instruc-

tions cause ANTIC to display a number of horizontal scan lines with a solid background color. Jump instructions are analogous to a 6502 JMP instruction; they reload ANTIC's program counter with a new value. There are also four special options that can sometimes be specified by setting a designated bit in the ANTIC instruction. These options are: *display-list interrupt* (DLI), *load-memory scan* (LMS), *vertical scroll*, and *horizontal scroll*.

Map-mode instructions cause ANTIC to display a mode line containing pixels with solid color in them. The color that is displayed comes from a color register. The choice of color register is specified by the value of the screen data. In four-color map modes (BASIC modes 3, 5, and 7, and ANTIC modes hexadecimal 8, A, D, and E), a pair of bits is required to specify a color register; these values are given in table 1. [Unfortunately, the graphics mode numbers in BASIC do not correspond to the mode numbers used by ANTIC; this often causes confusion....GW]

Since only 2 bits are needed to specify one pixel, four pixels are encoded in each screen-data byte. For example, a byte of screen data containing the hexadecimal value 1B would display four pixels; the first would be the background, the second would be color register 0, the third would be color register 1, and the fourth would be color register 2:

hexadecimal 1B
= binary 00011011
= 00 01 10 11

In two-color map modes (BASIC modes 4, 6, and 8, and ANTIC modes hexadecimal 9, B, C, and F), each bit specifies one of two color registers. A bit value of 0 selects background color for the pixel; a bit value of 1 selects color register 0 for the pixel. Eight pixels can be stored in one screen-data byte.

There are eight different map-display modes. They differ in the number of colors they display (two colors versus four colors), the vertical size one mode line occupies (1, 2, 4,

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ANTIC Mode	BASIC Mode	Number of Colors	Scan Lines Per Mode Line	Pixels Per Mode Line	Bytes Per Line	Bytes Per Screen
2	0	2	8	40	40	960
3	none	2	10	40	40	760
4	none	4	8	40	40	960
5	none	4	16	40	40	480
6	1	5	8	20	20	480
7	2	5	16	20	20	240
8	3	4	8	40	10	240
9	4	2	4	80	10	480
A	5	4	4	80	20	960
B	6	2	2	160	20	1920
C	none	2	1	160	20	3840
D	7	4	2	160	40	3840
E	none	4	1	160	40	7680
F	8	2	1	320	40	7680

Table 2: Atari graphics modes and their characteristics. Note that the same graphics mode is given a different number by BASIC and by ANTIC. The ANTIC mode number refers to one mode line of a given kind of graphics, while the BASIC mode number refers to a certain arrangement of mode lines (most or all of which are the given kind of graphics) that defines an entire screen of video display.

or 8 scan lines), and the number of pixels that fit horizontally into one mode line (40, 80, 160, or 320). Thus, some map modes give better resolution; these will require more screen memory. Table 2 presents this information for all modes.

Character-mode instructions cause ANTIC to display a mode line with characters in it. Each byte in screen RAM specifies one character. There are six character-display modes. Character displays will be discussed in a future BYTE article in this series.

Blank-line instructions produce "blank" lines consisting of only a

solid background color. There are eight blank-line instructions; they specify skipping one through eight blank lines.

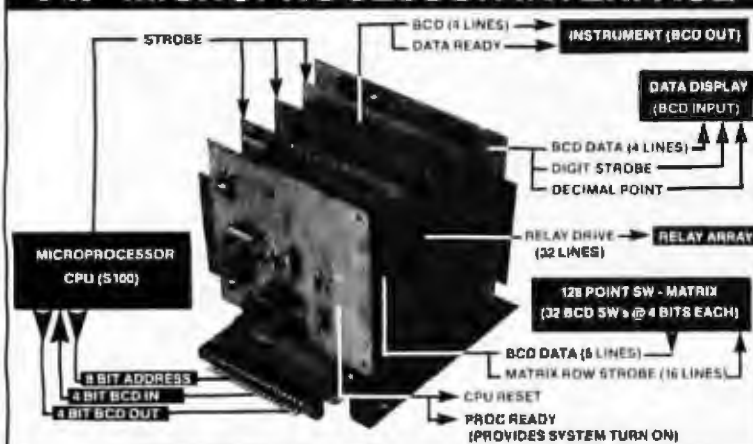
There are two jump instructions. The first (JMP) is a direct jump; it reloads ANTIC's program counter with a new address that follows the JMP instruction as an operand. Its only function is to provide a solution to a tricky problem. ANTIC's program counter is only 10 bits wide. Thus, it cannot cross a 1 K-byte boundary. If the display list must cross a 1 K-byte boundary, it must use a JMP instruction to hop over the

boundary. This means that display lists are not fully relocatable.

The second jump instruction (JVB) is more commonly used. It reloads the program counter with the value in the operand and waits for the television to perform a vertical blank. This instruction is normally used to end a display list by jumping to the top of the display list. Jumping to the top turns it into an infinite loop; ANTIC waits for vertical blank to insure that the infinite loop is synchronized to the display cycle of the television. Both JMP and JVB are 3-byte instructions; the first byte is the operation code (JMP or JVB), the second and third bytes are the address to jump to (low byte, then high byte).

The four special options mentioned previously will be discussed in future articles in this series. However, the load-memory scan option must have a preliminary explanation. This option is selected by setting bit 6 of a map-mode or a character-mode instruction byte. When ANTIC encounters such an instruction, it will load its memory-scan counter with the two following bytes. This memory-scan counter tells ANTIC where the screen memory is, and ANTIC begins fetching display data from this area. The LMS instruction is a 3-byte instruction: a 1-byte operation code followed by 2 bytes of operand. In simple display lists, the LMS in-

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format. This is best done on paper. Lay out the screen image and translate it into a sequence of mode lines. Keep track of the scan-line count of your display by looking up the scan-line requirements of the various modes in table 2. Translate the sequence of mode lines into a sequence of ANTIC mode bytes. Put 3 "blank-eight-lines" bytes (hexadecimal 70) at the top of the list. Set bit 6 of the first display byte (that is, make the upper nybble a 4)—this makes it a load-memory scan command. Follow with 2 bytes that specify the address of the screen RAM (low byte, then high). Then follow this with the rest of the display bytes. At the end of your display list, put in the JVB instruction (hexadecimal 41) and the address of the top of the display list. Store all these bytes into memory. They can be anywhere you want; just make sure they don't overlie something else, and be sure your JVB instruction at the end of the display list points to the top of the display list.

The display list must not cross a 1 K-byte address boundary. If you absolutely must have it cross such a boundary, insert a JMP instruction just in front of the boundary, with the JMP instruction's operand being the address of the first byte on the other side of the boundary. Next, you must turn off ANTIC for a fraction of a second while you rewrite its display-list pointer. Do this by writing a 0 into hexadecimal location 22F (known as SDMCTL). Then store the address of the new display list into hexadecimal locations 230 and 231 (low byte, then high). Lastly, turn ANTIC back on by depositing a hexadecimal 22 into SDMCTL. During the vertical blank, while ANTIC is quiet, the operating system will reload ANTIC's program counter with these new values.

Screen-Data Placement

Screen memory can be placed anywhere in the address space of the computer. Normally, the display list specifies the beginning of the screen memory with the first display instruction—the initial LMS instruction.

However, ANTIC can execute a new LMS instruction with each display line of the display list, if this is desired. In this way, information from all over the address space of the computer can be displayed on a single screen. This can be of value in setting up independent text windows.

There are several restrictions in your placement of the screen memory. First, screen memory should not cross a 4 K-byte address boundary. If you cannot avoid crossing a 4 K-byte boundary (as would be the case in BASIC mode 8, which uses 8 K bytes of RAM), you must reload the memory-scan counter with a new LMS instruction. Second, if you wish to use any of the Atari

Screen memory can be placed anywhere in the address space of the computer.

operating-system screen routines, you must abide by the conventions the operating system uses. This can be particularly difficult when using a modified display list in a BASIC program. If you alter a standard display list from a BASIC program and then attempt to PRINT or PLOT to the screen, the operating system will do so under the assumption that the display list is unchanged. This will probably result in a garbled display.

There are three ways the display can fail when you attempt this. First, BASIC may refuse to carry out a screen operation because it is impossible to do with the graphics mode that the operating system thinks it is in. The operating system stores the value of the graphics mode that it thinks is on the screen in hexadecimal address 57. You can fool the operating system into cooperating by POKEing a different BASIC mode value there. POKE the BASIC mode number, *not* the ANTIC mode number.

The second failure arises when you mix mode lines with different screen-memory byte requirements. Some mode lines require 40 bytes per line, some require 20 bytes per line, and some require only 10 bytes per line.

Let's say that you insert one 20-byte mode line into a display list with 40-byte mode lines. Then you PRINT text to the display. Everything above the interloper line is fine, but below it the characters are shifted twenty spaces to the right. This is because the operating system assumed that each line would require 40 bytes and positioned the characters accordingly. But ANTIC, when it encountered the interloper line, took only 20 bytes of what the operating system thought should be a 40-byte line. ANTIC interpreted the other 20 bytes as belonging to the next line and displayed them there. This resulted in the next line and all later lines being shifted twenty spaces to the right.

The only absolute way around this problem is to refrain from using BASIC PRINT and PLOT statements to output to a mixed display-list screen. The quick and dirty solution is to organize the screen into line groups that contain integer multiples of the standard byte requirement. That is, do not insert a 20-byte mode line into a 40-byte display; instead, insert two 20-byte lines or one 20-byte line and two 10-byte lines. As long as you retain the proper integer multiples, the horizontal shift will be avoided.

This solution accentuates the third problem with mixed display lists and BASIC: vertical shifts. The operating system positions screen material vertically by calculating the number of bytes to skip down from the top of the screen. In a standard 40-byte line display, BASIC would position the characters onto the tenth line by skipping 360 bytes (40 bytes per line times 9 full lines) from the beginning. If you have inserted four 10-byte lines, BASIC ends up 3 lines further down the screen than you would otherwise expect. Furthermore, different mode lines consume different numbers of scan lines, so the position on the screen will not be quite what you expected if you do not take scan-line costs into account.

As you can see, mixed-mode displays can be difficult to use in conjunction with the operating system. Often, you must fool the operating system to make such displays work.

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To PRINT or PLOT to a mode window, POKE the BASIC mode number of that window to hexadecimal location 57, then POKE the address of the top left pixel of the mode window into hexadecimal locations 58 and 59 (low byte, then high). In character modes, execute a POSITION 0,0 to home the cursor to the top left corner of the mode window. In map modes, all PLOTs and DRAWTOs will be made using the top left corner of the mode window as the origin of the coordinate system.

The display-list system can be used to produce appealing screen displays. Its most obvious use is for mixing text and graphics. For example, you could prepare a screen with a bold BASIC mode 2 title, a medium-size BASIC mode 1 subtitle, and small BASIC mode 0 fine print. You could then have a BASIC mode 8 picture in the middle, with more text at the bottom.

With assembly-language routines, modified display lists are best used by organizing the screen into a series of windows, each window having its own LMS instruction and its own independent RAM area.

Modification Applications

One simple application of display-list modifications is to vertically space lines on the screen by inserting blank-line bytes. This will add some vertical spacing, which will highlight critical messages and enhance the readability of some displays.

Another important use of display-list modifications is in providing access to features not available from BASIC. There are three text modes supported by ANTIC that BASIC does not support. You can gain access to these modes only by modifying the display list. There are also display-list-interrupt and fine-scrolling capabilities that are only available after the display list is modified. These features are the subjects of later articles in this series.

Manipulations with the LMS instruction and its operand offer many possibilities to the creative programmer. For example, by changing the LMS during vertical blank, the programmer can alternate screen images.

	Pixel Contents (By Color Register)											
first frame	1	1	1	1	2	3	2	3	2	3	2	3
second frame	B	1	1	1	B	B	2	3	2	3	2	3
third frame	B	B	1	1	B	B	B	B	2	3	2	3
fourth frame	B	B	B	1	B	B	B	B	B	B	2	3
effective luminance $\times 4$	2	4	6	8	10	12	20	24	30	36	40	48
perceived luminance												

Table 4: Advanced color and luminance control through the high-speed changing of the video display; see the text for details.

This can be done at slow speed to change between predrawn displays without having to redraw each one. Each display would continue to reside in (and consume) memory even while it is not in use, but it would be available almost instantly. This technique can also be used for animation. By flipping through a sequence of displays, cyclic animation can be achieved. The program to do this would manipulate only 2 address bytes to display thousands of bytes of memory.

It is also possible to superimpose images by flipping screens at high speed. The human eye has a time resolution of about $\frac{1}{60}$ of a second,

so a program can cycle between four images, one every $\frac{1}{60}$ of a second, so each repeats every $\frac{1}{15}$ of a second. In this way, up to four images can appear to reside simultaneously on the screen. There are some drawbacks to this method. First, four separate displays may well cost a lot of memory. Second, each display image will be washed out because it only shows up one quarter of the time. This means that the background of all displays must be black, and each image must be bright. Furthermore, there will be some unpleasant screen flicker when this technique is used. A conservative programmer might consider cycling between only three or

even two images. This technique can also be used to extend the color and luminance resolution of the computer. By cycling between four versions of the same image, each version stressing one color or luminance range, a wider range of colors and luminosities is available.

For example, suppose we wish to display a bar of many different luminances. We first set our four color registers to the following hexadecimal values:

```
background: 00
playfield 1: 02
playfield 2: 0A
playfield 3: 0C
```

If we put the images described in table 4 into each of the screen-memory areas, we can achieve much finer luminance resolution.

A final suggestion concerns a subject that is laden with opportunities, but that is as little understood as the dynamic display list. This is a display list that the 6502 changes during vertical-blank periods. It should be possible to produce interesting effects with dynamic display lists. For example, a text-editing program could dynamically insert blank lines above and below the screen line being edited to set it apart from the other lines of text. As the cursor is moved vertically, the display list is changed to isolate the screen line the cursor is on. The technique is odd but very effective.

Conclusions

The display list is a powerful system for creating and controlling displays. It is not a simple system. In essence, it is a scheme for mating two completely different technologies, the television and the microcomputer. When I consider the differences between these two technologies and the exacting demands of each, I am surprised that the display-list system achieves such a favorable combination of power and simplicity. Even more surprising is the way the display-list system supports an even more powerful set of graphics capabilities, such as graphics indirection, display-list interrupts, and fine scrolling. These will be the subjects of future articles in this series. ■

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Ciarcia's Circuit Court?

Dear Steve,

I am a member of the Evanston Township High School Computer Club, and I was wondering if you could settle a dispute for me. The supervisor of our computer room will not allow us to double-side our floppy disks because of the fact that they accelerate the accumulation of oxide and dust deposits on the read/write head of the disk drive. Is this true?

Scott Coleman
Evanston IL

I don't like to jump into the middle of disputes, but if you can live with my opinion, I will voice it. It should not make any difference whether you have a single-sided or double-sided disk. The disk-drive head does not come in contact with the oxide surface: it rides above it. So, theoretically, it should not cause any accumulation on the read/write head.

Now, that's in theory. In truth, there's always some oxide that comes off on the head, but if the computer room is doing regular maintenance, which is to clean the heads every once in a while, it should never be built up to a point at which it makes any difference anyway.

Perhaps the way to settle this is to have the computer club volunteer to clean the disk drives once in a while.

... Steve

Tools of the Course

Dear Steve,

I am beginning implementation of a hands-on micro-computer experimentation and interfacing course here at the University of Dubuque

Theological Seminary. I want to establish a digital-micro-processor laboratory. What would you consider to be the minimum test equipment necessary? Our financial resources are somewhat limited, so your advice would be most helpful.

Terry A Ward
Dubuque IA

At the very minimum, I would recommend that you get an oscilloscope. If you can afford it, it should be dual-trace and have at least a 15 MHz bandwidth. With it, you can troubleshoot many pieces of equipment and perform some logic-analyzer functions. If you can afford it, of course, a logic analyzer is always a good piece of equipment to have around. However, you can spend so much time teaching people how to use a logic analyzer that you don't have any time left in the course.

Other than an oscilloscope, the only other piece of equipment that you probably need would be a simple digital voltmeter (DVM) or digital multimeter.

Often the things that are needed when teaching students are not the things that you can buy off the shelf as test equipment. Frequently, simpler equipment, such as a buffered LED (light-emitting diode) that functions as a logic probe, is what's necessary.

A logic probe, 'scope, and a DVM should take care of practically anything that would arise. ... Steve

Auto Warning

Dear Steve,

In a book on microcomputers that I read, the author predicted that an automotive

warning device that would tell drivers they were too close to another vehicle would be devised.

It occurred to me that such a gadget might be realized right now using the Polaroid development kit and a simple single-board computer. Software, it seems to me, might be the biggest hurdle. What do you think?

Bob Crafts
Edgartown MA

The Polaroid ranging sensor is definitely usable for a driver-warning device like the kind you mentioned. However, I don't see this sensor being used as a crash-avoidance device because its response time is a little slow. I have seen one company using the device on each side of a car's fenders, with a dash-mounted display for the driver. In my mind, while this may work, its feasibility and production is another matter. It would seem to be rather expensive unless produced in large quantities.

When using the Polaroid development kit in an automobile, you must try to isolate the ignition noise from any power being drawn from the car's electrical system. From my experience, the Polaroid ranging kit is also electromagnetic interference and static sensitive. If used in a car, it should be in a shielded enclosure. ... Steve

Scheming Schematics

Dear Steve,

I would like to expand an Atari 400 or 800 with minimum programmable memory to a full 64 K memory by using 4116 chips. To this expansion board, I would also like to add RS-232C circuitry to handle a printer and

modem. Of course, it would need its own power supply.

I am a technician with a good background in digital electronics but not a circuit designer. Where can I find the necessary schematic and parts list?

Emanuel Soffer
Rockaway NY

Expanding the memory and adding RS-232C to the Atari are two completely different problems, each requiring diverse amounts of talent. The 6502 has no internal refresh logic, as does the Z80. External refresh logic must be added.

An RS-232C serial port can be added fairly easily to the expansion connector on the side of the Atari if the proper software is added to the unit. One company that has been working on this is the Code Works, POB 550, Goleta CA 93017. I suggest that you write the Code Works (attention Ron Jefferies) asking about its serial port for the Atari. It should be fairly inexpensive because it's practically all software.

Presently, it is cheaper to use static memory on the Atari. Whether this situation continues will be determined by the prices of dynamic versus static memory, the development of an inexpensive refresh method, or the evolution of new quasistatic programmable memories, such as the Zilog Z6132. If any readers have a good circuit for using dynamic memory with a 6502, I'd appreciate seeing it. ... Steve

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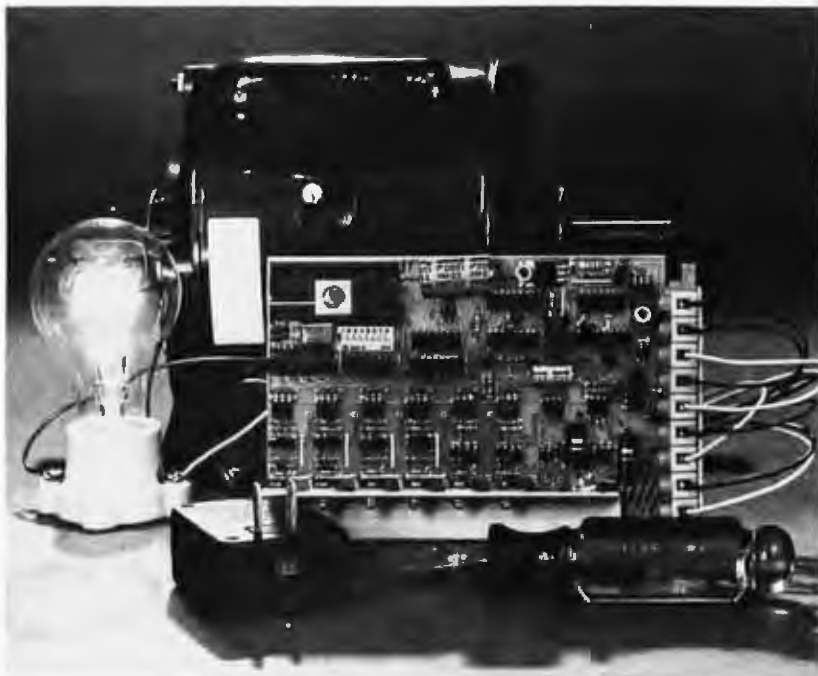
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CBASIC Program Directory

Compiler Systems Inc has published a directory listing 157 business-application programs as well as vertical-market packages written in CBASIC available from 30 software vendors. The CBASIC Software Directory provides a description of each program, its memory requirements, and the vendor's name, address, and telephone number. Unless noted, all products support CP/M and MP/M and require at least one floppy-disk drive. The directory is available for \$14.95 from Compiler Systems Inc, 37 N Auburn Ave, POB 145, Sierra Madre CA 91024, (213) 355-1063.

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Single-Board Computer

A single-board computer with analog, serial, and power-control I/O (input/output) has been announced by Wintek. The board features a 6801 or 68701 microprocessor with 2 K bytes of ROM (read-only memory), 128 bytes of programmable memory, and an internal and an external timer. The 12-bit A/D (analog-to-digital) converter can be configured for eight single-ended or four differential inputs. The eight digital I/O lines can be configured for

any mix of AC or DC inputs or outputs. The serial I/O allows half-duplex 20 mA current-loop communication to a host computer at software-selectable rates.

The prices range from \$88 to \$295, depending on options and quantity. Applications include remote data acquisition, machinery control, and energy management. Contact Wintek Corporation, 1801 South St, Lafayette IN 47904, (317) 742-8428.

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Software for the Atari

Personal Software has introduced MicroChess and Checker King for the Atari 400 and 800 microcomputers. Both games feature an on-screen, real-time clock for game timing. The games require 8 K bytes of memory and are priced at \$19.95 each, on cassette.

The MicroChess program turns a color-display screen into a chessboard. It has eight selectable

levels of play, plays by tournament rules, and allows no illegal moves.

Checker King allows single, double, and triple jumps, forces jumps, and performs according to the tournament rules of checkers. For details, contact Personal Software Inc, 1330 Bordeaux Dr, Sunnyvale CA 94086, (408) 745-7841.

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The Atari Tutorial

Part 2: Graphics Indirection

Chris Crawford
Atari Inc
1265 Borregas Ave
POB 427
Sunnyvale CA 94086

Indirection is a powerful concept in computing, but a difficult one for the beginning programmer to appreciate. In 6502 assembly language, there are three levels of indirection in referring to numbers. The first and most direct level is the immediate addressing mode, in which the number itself is directly stated:

LDA #SF4

The second level of indirection is reached when the program refers to a memory location that holds the number:

LDA \$0602

The third and highest level of indirection is attained when the program refers to a pair of memory locations that together contain the address of the memory location holding the number. In the 6502, this indirection is complicated by the addition of an index:

LDA (\$D0),Y

Indirection provides a greater degree of generality and power to the programmer. Instead of trucking out the same old numbers every time something needs to be done, the programmer can simply point to them.

By changing the pointer, the behavior of the program can be changed. Indirection is an important capability.

Graphics indirection is built into the Atari Personal Computer system in two ways: with color registers and character sets. Programmers using this computer after programming other systems often think in terms of direct colors. A color register is a more complex beast than a color. A color specifies a permanent value. A color register is indirect; it holds any color value. The difference between the two is analogous to the difference between a box-end wrench and a socket wrench. The box-end wrench comes in one size only, but a socket wrench holds almost any size socket. A socket wrench is more flexible, but takes a little more skill to use properly. Similarly, a color register is more flexible than a color, but takes more skill to use effectively.

Color-Register Indirection

The Atari 400/800 has nine color registers; four are for player-missile graphics and will be discussed in a later article in this series. The remaining five are not always used. Depending on the graphics mode used, as few as two registers, or as many as five, will show up on the screen. In BASIC mode 0, only one and one-half

registers are used because the hue value of the characters is ignored. Characters take the same hue as playfield register 2, but take their luminance from register 1. The color registers are in CTIA (one of the Atari custom integrated circuits) at hexadecimal addresses D016 through D01A. They are "shadowed" (ie: copied) from certain RAM (random access read/write memory) locations in the Atari OS (operating system) into CTIA during the vertical blank interrupt of the video display. Table 1 gives color-register shadow and hardware addresses.

For most purposes, the user controls the color registers by writing to the shadow locations. There are only two cases in which the programmer writes directly to the CTIA addresses. The first and most common is the display-list interrupt, which will be covered in a later article in this series. The second case arises when the user disables the OS vertical-blank interrupt routines, which move the shadow values from the OS into CTIA.

Colors are encoded in a color register by a simple formula. The upper nybble gives the hue value, which is identical to the second parameter of the BASIC SETCOLOR command. Table 9.3 of the *Atari BASIC*

Reference Manual lists hue values. The lower nybble in the color register gives the luminance value of the color. It is the same as the third parameter in the BASIC SETCOLOR command. The lowest-order bit of this nybble is not significant. Thus, there are eight luminances for each hue. This gives a total of 128 colors from which to choose (eight luminances times sixteen hues). In this series of articles, the term *color* denotes a hue-luminance combination.

Once a color is encoded into a color register, it is mapped onto the screen by referring to the color register that holds it. In map-display modes that support four color registers, the screen data specify which color register is to be mapped onto the screen. Since there are four color registers, it takes only 2 bits to encode one pixel. Thus, each screen-data byte holds data for four pixels. The value in each pair of bits specifies which color register provides the color for that pixel.

In color-text display modes

(BASIC's graphics modes 1 and 2), the selection of color registers is made by the top 2 bits of the character code. This leaves only 6 bits for defining the character, which is why these two modes have only 64 characters available.

Color-register indirection gives the programmer four special capabilities. First, the programmer can choose from 128 different colors for displays.

Second, the programmer can manipulate the color registers in real

time to produce pretty effects. The simplest version of this is demonstrated by the following BASIC line:

```
FOR I=0 TO 254 STEP 2:POKE 712,I:NEXT I
```

This line cycles the border color through all possible colors. The effect is quite pleasing and certainly grabs attention. The fundamental technique can be extended in a variety of ways. A special variation of this is to create

Image Controlled			Operating System Shadow	
Hardware				
	Label	Hexadecimal Address	Label	Hexadecimal Address
player 0	COLPM0	D012	PCOLR0	2C0
player 1	COLPM1	D013	PCOLR1	2C1
player 2	COLPM2	D014	PCOLR2	2C2
player 3	COLPM3	D015	PCOLR3	2C3
playfield 0	COLPF0	D016	COLOR0	2C4
playfield 1	COLPF1	D017	COLOR1	2C5
playfield 2	COLPF2	D018	COLOR2	2C6
playfield 3	COLPF3	D019	COLOR3	2C7
background	COLBK	D01A	COLOR4	2C8

Table 1: Names and addresses of color registers used by the Atari 400/800.

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System Requirements

- CP/M (1.4 or later)
- 32 K bytes of memory
- One or two disk drives

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simple cyclic animation by drawing a figure in four colors, and then cycling the colors through the color registers, rather than redrawing the figure. The program in listing 1 illustrates the idea.

The third application of color registers is to logically key colors to situations. For example, a paged-menu system can be made more understandable by changing the background color or the border color for each page in the menu. Perhaps the screen could flash red when an illegal key is pressed. The use of the color characters available in BASIC graphics modes 1 and 2 can greatly extend the impact of textual material. An account sum could be shown in red if the account is in the red, or black if the account is in the black. Words or phrases of import can be emphasized in special colors. The use of colors in map modes (no text) can also improve the utility of such graphics. A single graphics image (a monster, a boat, or whatever) could be presented in several different colors to represent several versions of the same thing. It costs a great deal of RAM to store an image, but it costs very little to change the color of an existing image. For example, it is much easier to show three different boats by presenting one boat shape in three different colors than three different boat shapes.

The fourth and most important application of color registers is used with display-list interrupts. A single

color register can be used to put up to 128 colors onto a single screen. This important capability will be discussed in part 4 of this series.

Character Sets

Graphics indirection is also provided through the redefinable character set. A standard character set is provided in ROM (read-only memory), but there is no reason why this particular character set must be used. The user can create and display any character set desired. There are three steps necessary to use a redefined character set. First, the programmer must define the character set. This is the most time-consuming step. Each character is displayed on the screen on an 8 by 8 grid, which is encoded in memory as an 8-byte table. Table 2 depicts the encoding arrangement.

A full character set has 128 characters in it, each with a normal and inverse video incarnation. Such a character set needs 1024 bytes of space and must start on a 1 K-byte boundary. Character sets for BASIC modes 1 and 2 have only 64 distinct characters. These require only 512 bytes and must start on a ½ K-byte boundary. The first 8 bytes define the zeroth character, the next 8 bytes define the first character, and so on. Each group of 8 bytes is termed a *character definition*; the index that designates such a group (FIRST character, FIFTH character, etc) is called the *character name*. Obviously, defining a new character set is a big job. Fortunately, there are software

packages to make this job easier.

Once the character set is defined and placed into RAM, the second step is to tell ANTIC (another custom integrated circuit on the Atari 400/800) where it can find the character set. This is done by poking the page number of the beginning of the character table into hexadecimal location D409 (decimal 54281). The OS shadow location, the location normally used, is called CHBAS and resides at hexadecimal 2F4 (decimal 756). The third step in using character sets is to print the character wanted onto the screen. This can be done directly from BASIC with simple PRINTs or by writing numbers directly into the screen memory.

A special capability of the system not supported in BASIC is the four-color, character-set option. BASIC graphics modes 1 and 2 support five colors, but each character in these modes is really a two-color character; each one has a foreground color and a background color. The foreground color can be any of four single colors, but only one color at a time can be shown within a single character. This can be a serious hindrance when using character graphics.

There are two other text modes designed especially for character graphics, ANTIC modes 4 and 5. Each character in these modes is only four pixels wide, but each pixel can have four colors (counting background). The characters are defined like BASIC graphics mode 0 characters, except that each pixel is twice as wide and has 2 bits assigned to it to

Listing 1: A short graphics program demonstrating the illusion of movement by changing color-register assignments.

```
10 GRAPHICS 23
20 FOR X=0 TO 39
30 FOR I=0 TO 3
40 COLOR I
50 PLOT 4*X+1,0
60 DRAWTO 4*X+1,95
70 NEXT I
80 NEXT X
90 A=PEEK(712)
100 POKE 712,PEEK(710)
110 POKE 710,PEEK(709)
120 POKE 709,PEEK(708)
130 POKE 708,A
140 GOTO 90
```

CHARACTER IMAGE	BINARY REPRESENTATION	HEXADECIMAL REPRESENTATION
	0 0 0 0 0 0 0 0	0 0
	0 0 0 1 1 0 0 0	1 8
	0 0 1 1 1 1 0 0	3 C
	0 1 1 0 0 1 1 0	5 5
	0 1 1 0 0 1 1 0	6 6
	0 1 1 1 1 1 1 0	7 E
	0 1 1 0 0 1 1 0	5 5
	0 0 0 0 0 0 0 0	0 0

Table 2: Internal representation of a character in memory. One character needs 8 bytes to represent it. Although the standard character set is in ROM, the pointer to the beginning of the character set can be changed to point to other memory locations, allowing the user to create a modified or completely new character set.

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specify the color register used. Unlike ANTIC modes 6 and 7 (BASIC modes 1 and 2), color-register selection is not made by the character-name byte, but instead by the defined character set. Each byte in the character table is broken into four bit pairs, each of which selects the color for a pixel. (This is why there are only four horizontal pixels per character.) The highest bit (D7) of the character-name byte modifies the color register used. Color-register selection is made according to table 3.

Using these text modes, multicolored graphics characters can be put onto the screen.

Another interesting ANTIC character mode is the lowercase-descenders mode (ANTIC mode 3). This mode displays ten scan lines per mode line, but since characters use

only 8 bytes vertically, the lower two scan lines are normally left empty. If a character in the last quarter of the character set is displayed, the top two scan lines of the character will be left empty. The data that should have been displayed there will be shown on the bottom two lines (see figure 1). This allows the user to create lowercase characters with descenders.

Modified Character Sets

Many interesting and useful application possibilities spring from character-set indirection. The obvious application is the modified font. A different font can give a program a unique appearance. It is possible to have Greek, Cyrillic, or other special character sets. Going one step further, graphics fonts can be created. The Energy Czar computer program

Bit Pair In Character Definition	Color Register Selected	
	D7=0	D7=1
00	COLBAK	COLBAK
01	PF0	PF0
10	PF1	PF1
11	PF2	PF3

Table 3: Use of color registers in character definition during ANTIC graphics modes 4 and 5. See the text for details.

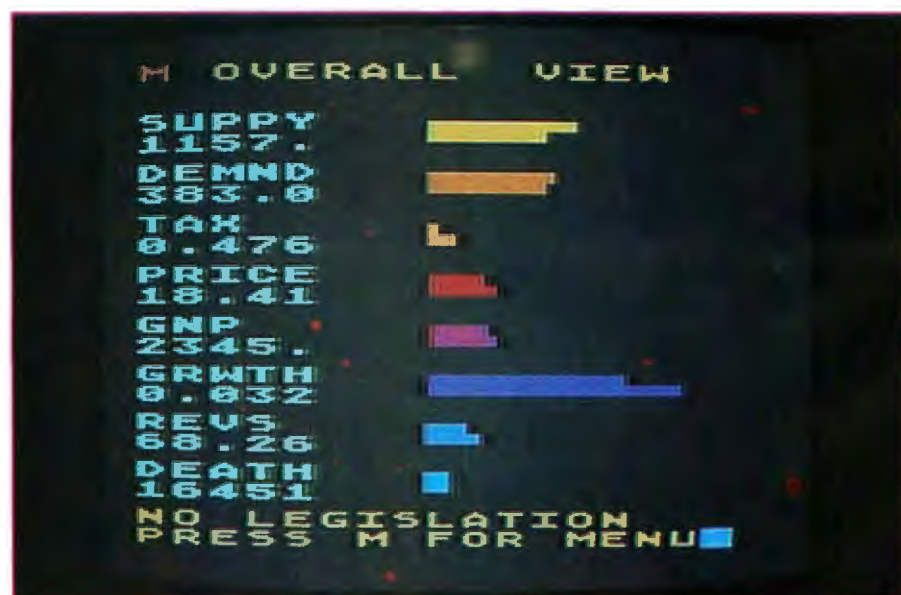


Photo 1: A bar chart made using character graphics. Even though each character is eight pixels wide, the horizontal bars can be any number of pixels wide by using redefined characters representing bars of varying width.



Photo 2: Two views of a war-game map made totally from character graphics. The map is several times larger than the video display, and a player can use a joystick to view different parts of the map. Even though character-sized graphics are used, the scrolling appears to be smooth due to some advanced Atari display techniques.

(sold by Atari) uses a redefined character set for bar graphs. A character occupies eight pixels. This means that bar charts implemented with standard characters have a resolution of eight pixels, a rather poor resolution. Energy Czar uses a special character set in which some of the less useful text symbols (ampersands, pound signs, etc) have been replaced with special bar-chart characters. One character is a one-pixel bar, another is a two-pixel bar, and so on to the full eight-pixel bar. The program can thus draw detailed

bar charts with resolution of a single pixel. Photo 1 shows a typical display from this program. The mix of text with map graphics is only apparent; the entire display is constructed with characters.

In many applications, character sets can be created that show special images. For example, by defining a terrain graphics character set with river characters, forest characters, mountain characters, and so forth, it is possible to make a terrain map of any country. With imagination, a terrain map of a different planet can just

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as easily be done. When doing this, it is best to define five to eight characters for each terrain type. Each variation of a single type should be positioned slightly differently in the character pixel. By mixing the different characters together, it is possible to avoid the monotonous look characteristic of primitive character graphics. Most people won't realize that the resulting map uses character graphics until they study the map closely. Photo 2 shows two views of a terrain map created with character-set graphics.

You could create an electronics character set with transistor characters, diode characters, wire characters, and so forth to produce an electronics schematics program. Or you could create an architectural character set with doorway characters, wall characters, corner characters, and so on to make an architectural blueprint program.

Characters can be turned upside down by POKEing a 4 into decimal location 755. One possible applica-

tion of this feature might be for displaying playing cards (as in a blackjack game). The upper half of the card can be shown right-side up; with a display-list interrupt, the characters can be turned upside down for the lower half of the card. This feature might also be useful in displaying images with mirror reflections (reflection pools, lakes, etc).

Even more exciting possibilities spring to mind when it is realized that it is practical to change character sets while the program is running. A character set costs either 512 bytes or 1024 bytes; in either case, it is inexpensive to keep multiple character sets in memory and flip between them during program execution. There are three time regimes for such character-set multiplexing: human slow (more than 1 second), human fast (1/60 second to 1 second), and machine fast (faster than 1/60 second).

Human-slow character-set multiplexing is useful for *change of scenery* work. For example, a space-travel program might use one graphics

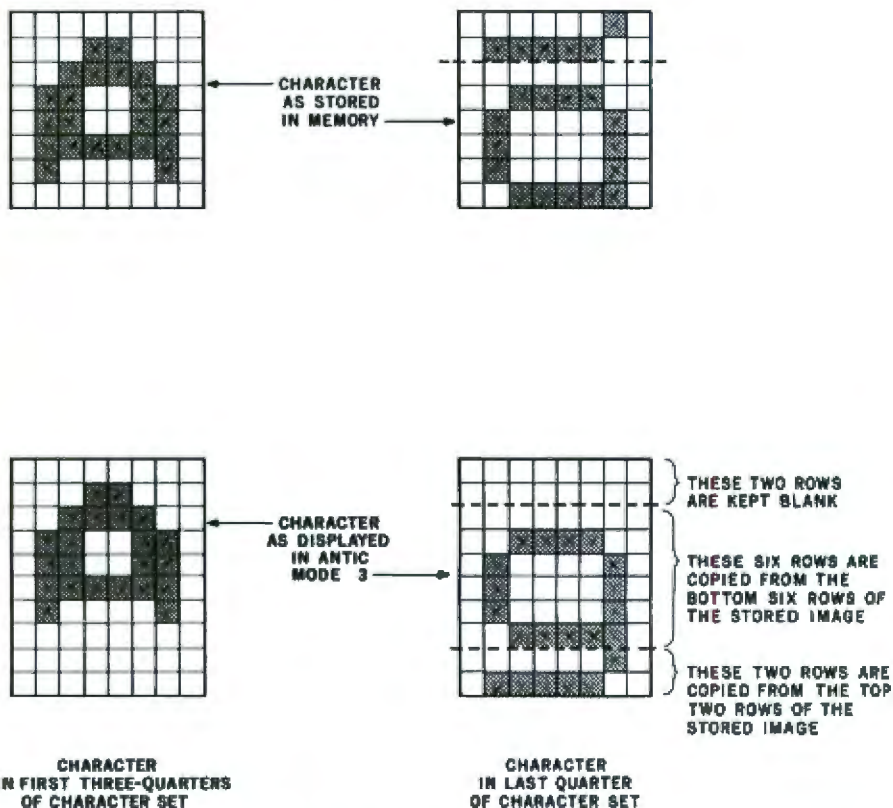


Figure 1: Lowercase descenders in ANTIC mode 3. Using the method shown here, the Atari 400/800 can display characters in an 8 by 10 matrix, even though their internal representation is an 8 by 8 matrix.

character set for one planet, another set for space, and a third set for another planet. As the traveler changes locations, the program changes the character set to give exotic new scenery. An adventure-type program might change character sets as the player changes locales.

Human-fast character-set multiplexing is primarily of value for animation. This can be done in two ways: changing characters within a single character set, and changing whole character sets. The Space Invaders game on the Atari 400/800 uses the former technique. The invaders are actually *characters*. By rapidly changing the characters, the programmer was able to animate them. This was easy because there are only six different monsters, each with four different incarnations. High-speed cyclic animation of an entire screen is possible by setting up a number of character sets, drawing the screen image, and then cycling through the character sets. If each character has a slightly different in-

carnation in each of the character sets, that character will go through an animated sequence as the character sets are changed. In this way, a screen full of objects could be made to cyclically move with a simple loop. Once the character-set data are in place and the screen has been drawn, the code to animate the screen would be this simple:

```
1000 FOR I=1 TO 10
1010 POKE 756,CHARBASE(I)
1020 NEXT I
1030 GOTO 1000
```

Computer-fast character-set animation is used to put multiple character sets onto a single screen. This makes use of the display-list interrupt capability of the computer. This topic will be addressed further in a later article in this series.

The use of character sets for graphics and animation has many advantages and some limitations. The biggest advantage is that it costs little RAM to produce detailed displays. A

graphics display using BASIC mode 2 characters (such as the ones in photo 2) can give as much detail and one more color than a BASIC mode 7 display. Yet, the character image will cost 200 bytes, while the map image will cost 4000 bytes. The RAM cost for multiple character sets is only 512 bytes per set, so it is inexpensive to have multiple character sets. Screen manipulations with character graphics are much faster because you have less data to manipulate. However, character graphics are not as flexible as map graphics. You cannot put anything you want anywhere on the screen. This limitation precludes the use of character graphics in some applications. However, many graphics applications remain for which the program need display only a limited number of predefined shapes in fixed locations. In these cases, character graphics provide great utility. ■

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Atari's Telelink I

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Telelink I is a program cartridge for the Atari 400 or 800 personal-computer system that lets you access data bases, electronic mail, and other services offered by information utilities such as The Source and Compuserve. You must have the Atari 850 interface module and an Atari 830 modem, or the equivalent, to use Telelink I. One of Atari's printers, Atari 820, Atari 822, or Atari 825, may be used.

Telelink I comes with a well-prepared five-page manual explaining the use of the cartridge. Following a general introduction, the manual explains how to hook up the modem, telephone, and printers. It also describes some of the options for controlling the printers, the width of the screen, and the word or the character mode (which will be explained later). There are lists of what will be transmitted by each of the keys on the keyboard. Some

special control-character combinations send ASCII (American Standard Code for Information Interchange) characters not available on the Atari 400 and 800 keyboards. (For example, a Control-[sends a {.) A list of definitions of several data-communications terms is also included. Finally, the manual lists the ASCII character set with the decimal and hexadecimal values of each character. The meanings of the ASCII control characters are also given.

An offer to sign up with Compuserve and receive one hour of free time on Micronet is included when you buy Telelink I. Micronet has several services that may be of interest to the Atari user: one is the monthly Atari newsletter. Another service is a CB (citizen's band) radio simulator. Users can enter the CB simulator and talk with computer users across the country.

At a Glance

Name
Telelink I

Type
Communications utility

Manufacturer
Atari Inc
1346 Bordeaux Dr
Sunnyvale CA 94086
(800) 538-8547; in California
(800) 672-1404

Price
\$19.95

Format
Computer program cartridge
(read-only memory)

Language
6502 assembly language

Computer
Atari 400 or 800 computer
with an Atari 850 interface
module and an Atari 830
modem (or equivalent)

Documentation
5 pages, 8½ by 11 inches

Audience
Individuals wishing to use
information utilities and
timesharing networks

Control Features

Pressing Control-8 changes the width of the screen from 38 characters to 40 characters. Control-0 toggles between word mode and character mode. The character mode splits words at the edge of the screen; the word mode, which moves a word to the next line rather than splitting it, improves the readability of the text on the screen. This is also known as word wrap.

Atari's printers can be used with Telelink I to provide hard copy of a terminal session. Telelink I reserves a 1.5 K-byte buffer for the printer. This buffer can be printed automatically or under direct user control with the Select key. In the automatic mode, 1 K bytes of data are collected in the buffer, then an ASCII XOFF is transmitted to the sender. (XOFF is an ASCII control character meaning "stop sending data.") At this point, Telelink I stops looking for data from the modem and begins printing the information stored in the buffer. When the buffer

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is empty, Telelink I transmits an XON to the sender. (XON is an ASCII control character meaning "start sending data.") Once the buffer has been filled, this process is repeated. All this is automatic and is handy for copying information to the printer when no user interaction is required.

In the nonautomatic mode, data is received until 1 K bytes of data have been stored in the buffer. At this point, the keyboard begins to make a clicking noise, signaling that the buffer is nearly full. The user must do whatever is required by the communications protocol currently in use to stop the transmission of data. (Due to the serial data transmission on the Atari 400 and 800 peripheral bus, the Atari 850 interface module cannot share the bus with any other peripheral device, including the printer.) To print data, the Atari 850 must not be attempting to transmit or receive data. Telelink I causes the Atari 850 interface to cease monitoring the communication link for incoming data while printing the contents of the buffer. If the transfer of data is not stopped, the data that was received during printing will be lost.

Once the transfer has been stopped, the Select key may be pressed, and the contents of the buffer will be printed. When the contents of the buffer have been printed, the user should send the character(s) required to resume transmission of data. Another buffer will be filled and can be printed by repeating the procedure.

The options provide means to configure Telelink I to your needs. Pressing System Reset will set all of the options back to their default values. Although the automatic printer feature would be convenient, the two networks I tried, Compuserve (through Tymnet) and HDR Systems Inc (in Omaha, Nebraska), didn't respond to the XON and XOFF control characters. The nonautomatic mode will have to be used in cases where the host computer does not recognize XON and XOFF.

When an option is changed, the change is printed on the screen. Perhaps it would have been more helpful to reserve one line of the screen to show all the status information continuously. This would make it easy to determine exactly what mode the printer is in at any time. Another helpful feature Atari could have added is the ability to select local echo of keyboard input, rather than depending on the host computer to send back each character it receives.

Conclusions

- The Telelink I cartridge provides an easy way to turn your Atari 400 or 800 computer into a terminal for dialing into information utilities and timesharing networks such as The Source and Compuserve.
- The printer-control features make the cartridge valuable for an Atari system with a printer. The ability to get a hard copy of a terminal session is a definite plus.
- For an Atari system without a printer, the decision may be harder. A simple program to emulate a terminal using GET and PUT (in Atari BASIC) was given in the February 1981 *Compute*. The word mode is a nice feature and probably makes the cartridge worth the extra expense. ■

What's New?

MISCELLANEOUS

Rockwell's 68000

Rockwell International's Electronics Devices Division has unveiled the R68000 16-bit microprocessor. The device addresses up to 16 megabytes, has more than 1000 instructions, and can process 8-, 16-, or 32-bit data. The R68000 can be sampled in 4 and 6 MHz versions; an 8 MHz version is under development.

Additional devices in the R68000 family will include a peripheral controller, a memory manager, a DMA (direct memory access) controller, and a multiprotocol communications controller.

The price for the 4 MHz R68000 is \$210, the 6 MHz version is \$220, and the projected cost of the 8 MHz device is \$250. Contact Rockwell International, Electronic Devices Division, 3310 Miraloma Ave., POB 3669, Anaheim CA 92803, (714) 632-2321.

Circle 506 on inquiry card.

FORTH on a ROM

Martin Schaaf's full Z80 FORTH on a ROM (read-only memory) replaces the BASIC ROM in the TRS-80 Model I. A screen editor, 8080/Z80 assemblers, and a metacompiler that reproduces FORTH from high-level code are included. The price is \$250 from Martin Schaaf, POB 1001, Daly City CA 94017.

Circle 508 on inquiry card.

48 K-Byte Board for the Atari

The MM48001 is a 48 K-byte programmable-memory board for the Atari 400. It makes Atari 800 software compatible with the 400. The board costs \$299. Contact Intec, Suite 111, 3387 Del Rosa North, San Bernardino CA 92404, (714) 864-5269.

Circle 499 on inquiry card.

ZEN and the Art of Programming

ZEN is an operating system in the North Star format using 5-inch floppy disks. The system includes a word processor with line justification, file creation, and search and insertions. The monitor comes with memory testing, repeat cross-functions, and port controls. The assembler has global labels, partial print designation, stops, and trial assembly. It is available for \$75 from Zenrad Controls Company, 1575 A P S, Santa Barbara CA 93103, (805) 965-4996. Circle 506 on inquiry card.

System 6220 Counter/Timers

The System 6220 multifunction counter/timers can be combined to provide an array of display and control functions. Production quantities, flow, rotation, displacement, frequency, and elapsed time can be measured in process monitoring, test systems, and production control. Prices start at \$115 for the 6222 counter/timer. Contact Newport Electronics Inc, 630 E Young St., Santa Ana CA 92705, (714) 540-4914. Circle 509 on inquiry card.

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Rocky Mountain Software Systems has a complete business-software system available for \$199. The system is comprised of four software packages: General Ledger, Accounts Receivable, Accounts Payable, and Payroll. Written in MBASIC, the system will run on any CP/M-based microcomputer with at least 48 K bytes of programmable memory. Individual packages can be purchased separately for \$59. Contact Rocky Mountain Software Systems, POB 3282, Walnut Creek CA 94598.

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Computer Pollution Control

Electronic Specialists Inc, 171 S Main St., Natick MA 01760 (617) 655-1532, has announced Super Isolator, a device designed to control electrical spikes, surges, and noise. Super Isolator features three individually filtered AC sockets. Equipment interactions and disruptive or damaging power-line pollution are controlled. The Super Isolator controls pollution for an 1875 W load. Each socket can handle a 1000 W load. The Model ISO-3 Super Isolator costs \$94.95.

Circle 507 on inquiry card.

Memory Boards for the Atari

The AT-16, a 16 K-byte, 200 ns memory board, and the AT-32, a 32 K-byte, 200 ns board, are compatible with all existing Atari 400 and 800 software and hardware. They install with no modifications. The AT-16 costs \$119.50, and the AT-32 costs \$199.50. Contact Microtek Peripherals Corporation, 9514 Chesapeake Dr., San Diego CA 92123, (800) 854-1081; in California (714) 278-0630.

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TRS-80 Space Raiders

Space Raiders is a machine-language program that creates a detailed simulation of outer space combat. Current and target position, fuel, shield energy, and heading are all displayed. There are five levels of play.

Space Raiders runs on 16 K-byte Level II TRS-80 Model I microcomputers. It costs \$24.95. Contact Bosen Electronics, 445 E 800 North, Spanish Fork UT 84660, (801) 798-9553.

Circle 513 on inquiry card.

The Atari Tutorial

Part 3: Player-Missile Graphics

Chris Crawford
Atari Inc
1265 Borregas Ave
POB 427
Sunnyvale CA 94086

Animation is an important capability of any personal computer system. Activity on the screen adds greatly to the excitement and realism of any program. Certainly, animation is crucial to the appeal of most computer games. More important, an animated image can convey information with more impact and clarity than a static image. It can draw attention to an item or event of importance. It can directly show a dynamic process, rather than indirectly talk about it. Animation must accordingly be regarded as an important element of the graphics capabilities of any computer system.

The conventional way to implement animation with personal computers is to move the image data through the screen memory area. This is a two-step process. First, the program must erase the old image by writing background values (ie: the values of the image "under" the moving one) to the memory containing the current image. Then the program

must write the image data to the memory corresponding to the new position of the image. By repeating this process over and over, the image appears to move on the screen.

The essence of the problem of playfield animation: the screen image is two-dimensional, while the image in memory is one-dimensional.

There are two problems with this technique. First, if the animation is being done in a graphics mode with large pixels (picture elements), the motion will not be smooth; the image will jerk across the screen. With other computers, the only solution is to use a graphics mode with smaller pixels (higher resolution). The second problem is much worse. The screen is a two-dimensional image, but the screen memory is organized one-dimensionally. An image that is contiguous on the screen will not be contiguous in the screen memory. The discrepancy is illustrated in figure 1.

The significance of this discrepancy is not obvious until you try to write a program to move such an image. Look how the bytes that make up the image are scattered through memory. To erase them, your program must calculate their addresses. This calculation is not always easy to do. The assembly code just to access a single screen byte at screen location (XPOS,YPOS) would be as shown in listing 1 (this code assumes 40 bytes per screen line).

Clearly, this code to access a screen location is too cumbersome. It is not the most elegant or fastest code to solve the problem. A good programmer could take advantage of special circumstances to make the code more compact or elegant. The point of this is that accessing pixels on a screen takes a lot of computing. The routine in listing 1 takes about 100 machine cycles to access a single byte on the screen. To move an image that occupies, say 50 bytes, would require 100 accesses, 10,000 machine cycles, or roughly 10 ms. This may not sound like much, but if you want to achieve smooth motion, you have to move the object every 17 ms. If there are other objects to move or calcula-

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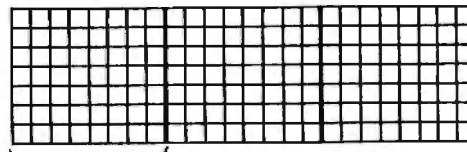
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00 00 00
00 99 00
00 8D 00
00 FF 00
00 8D 00
00 99 00
00 00 00

1 BYTE

SPACING OF BYTES IN MEMORY

00 00 00 00 99 00 00 8D 00 00 FF 00 00 8D 00 00 99 00 00 00 00

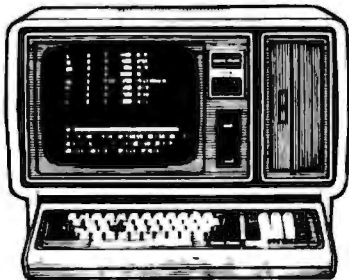
IMAGE BYTES SCATTERED THROUGH RAM

Figure 1: The problem of moving a bit-mapped graphics image. Although the image is two-dimensional, its representation is scattered through one-dimensional memory. The software necessary to change the appropriate memory locations slows down animation considerably.

Listing 1: A 6502 assembly-language program to move a bit-map image within a graphics screen that uses 40 bytes per line of graphics.

LDA	SCRNRM	Address of beginning of screen RAM
STA	POINTR	zero-page pointer
LDA	SCRNRM + 1	high-order byte of address
STA	POINTR + 1	high-order pointer
LDA	#000	
STA	TEMPA + 1	temporary register
LDA	YPOS	vertical position
ASL	A	times 2
ROL	TEMPA + 1	shift carry into TEMPA + 1
ASL	A	times 4
ROL	TEMPA + 1	shift carry again
ASL	A	times 8
ROL	TEMPA + 1	shift again
LDX	TEMPA + 1	save YPOS*8
STX	TEMPB + 1	into TEMPB
STA	TEMB	low byte
ASL	A	times 16
ROL	TEMPA + 1	
ASL	A	times 32
ROL	TEMPA + 1	
CLC		
ADC	TEMPB	add in YPOS*8 to get YPOS*40
STA	TEMPB	
LDA	TEMPA + 1	now do high-order byte
ADC	TEMPB + 1	
STA	TEMPB + 1	
LDA	TEMPB	TEMPB contains the offset from top of screen to pixel
CLC		
ADC	POINTR	
STA	POINTR	
LDA	TEMPB + 1	
ADC	POINTR + 1	
STA	POINTR + 1	
LDY	XPOS	
LDA	(POINTR), Y	

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tions to carry out, the 7 ms difference doesn't allow much processor time to devote to them. This means that this type of animation (called *playfield animation*) is too slow for many purposes. You can still get animation this way, but you are limited to a few objects, small objects, slow motion, or a few calculations between motion. The trade-offs a programmer must make in using such animation are too restrictive.

A New Approach—Players

The Atari 400/800 solution to this problem is player-missile graphics. In order to understand player-missile graphics, you must understand the essence of the problem of playfield animation: the screen image is two-dimensional, while the image in memory is one-dimensional. The solution was to create a graphics object that is one-dimensional on the screen, as well as one-dimensional in memory.

What Is Shadowing?

Some of the hardware registers talked about in this article are write-only—that is, you can write values to them, but you can't read what their current contents are. Because of this, the designers of the Atari operating system created shadow registers for some of the more important hardware registers. When the Atari 400/800 has finished drawing an entire display screen of information (at a time called the vertical blank), it copies the contents of each shadow register into the corresponding hardware register (this occurs every $\frac{1}{60}$ second). In this way, you can read the contents of a shadow register, knowing that it has the same value as its hardware register.

If you write to the hardware register itself, the old value (still in the shadow register) will be copied into the hardware register at the next vertical blank, and whatever effect you wanted to make will be almost instantly undone. Similarly, if you try to read the hardware-register location, you will get incorrect results.

To conclude, you should always read from and write to shadow registers where they exist. If you fail to do so, your program will fail to work in a way that is not always obvious.

This object (called a *player*) appears in memory as a table either 128 or 256 bytes long. The table is mapped directly to the screen. It appears as a vertical band stretching from the top of the screen to the bottom. Each byte in the table is mapped into either one or two horizontal scan lines, with the choice made by the programmer. The screen image is a simple bit-map of the data in the table. If a bit is on, the corresponding pixel in the vertical column is lit; if the bit is off, the corresponding pixel is off. Thus, the player image is not strictly one-dimensional; it is actually 8 bits wide.

Drawing a player image on the screen is simple. First, you draw a picture of the desired image on graph paper. This image must be no more than eight pixels wide. Then you translate the image into binary code, substituting 1s for illuminated pixels and 0s for empty pixels. You translate the resulting binary number into decimal or hexadecimal (depending on which is more convenient), and you store 0s into the player memory area to clear the image. Next, you store the image data into the player memory area, with the byte at the top of the player image going first, followed by the other image bytes in top-to-bottom sequence. The further down in memory you place the data, the lower the image will appear on the screen.

Animating this image is easy. Vertical motion is obtained by moving the image data through the player memory. This is, in principle, the same method used in playfield animation, but there is a big difference in practice. The move routine for vertical motion is a one-dimensional move instead of a two-dimensional move. The program does not need to multiply by 40 and it often does not need to use indirection. It could be as simple as:

```
LDX  #$01
LOOP LDA  PLAYER,X
      STA  PLAYER-1,X
      INX
      BNE  LOOP
```

This routine takes about 4 ms to move the entire player, about half as

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television to television; a conservative range is from 60 to 200. This coordinate range is sometimes clumsy to use, but it offers a nice feature: a simple way to remove a player from the screen is to set the player's horizontal position to zero. With a single load and store in assembly language (or a single POKE in BASIC), the player disappears.

The system described so far makes it possible to produce high-speed animation. There are a number of embellishments that greatly add to its overall utility. The first embellishment is that there are four independent players to use. These players all have their own sets of control registers and memory areas; thus, their operation is completely independent. The players are labeled P0 through P3. They can be used side by side to give up to 32 bits of horizontal resolution, or independently to give four movable objects. Each player has its own color register, completely independent of the playfield color register. The player color registers are called COLP(X) and are shadowed at PCOLR(X). This gives you the capability to put much more color onto the screen. However, each player has only one color; multi-colored players are not possible without *display-list interrupts* (which will be discussed in the next article in this series).

Each player has a controllable width. You can set it to have normal width, double width, or quadruple width with the SIZEP(X) registers. This is useful for making players take on different sizes. You also have the option of choosing the vertical resolution of the players. You can use single-line resolution, in which each byte in the player table occupies one horizontal scan line, or double-line resolution, in which each byte occupies two horizontal scan lines. With single-line resolution, each player bit-map table is 256 bytes long; with double-line resolution, each table is 128 bytes long. This is the only case where player properties are not independent. The selection of vertical resolution applies to *all* players. Player vertical resolution is controlled by bit D4 of the DMACTL

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register. In double-line resolution, the first 10 bytes in the player table area are lost to vertical overscan and are off the top edge of the screen, and the last 20 bytes are lost off the bottom edge of the screen. In single-line resolution, 20 and 40 bytes are lost correspondingly.

Missiles

The next embellishment is the provision of *missiles*. These are 2-bit-wide graphics objects associated with the players. There is one missile assigned to each player; it takes its color from the player's color register. Missile-shape data come from the missile bit-map table in memory in front of the player tables. All four missiles are packed into the same table (four missiles times 2 bits per missile gives 8 bits). Missiles can move independently of players; they have their own horizontal position registers. Missiles have their own size register, **SIZEM**, that can set the horizontal width as the **SIZEP(X)** registers do for players. However, missiles cannot be set to different sizes. They are all set together. Missiles are useful as bullets or for skinny vertical lines on the screen. If desired, the missiles can be grouped together into a fifth player, in which case they take the color of playfield color register 3. This is done by setting bit D4 of the priority control register (**PRIOR**). Missiles can still move independently when this option is in effect. Their horizontal positions are set by their horizontal position registers (**HPOSM0** through **HPOSM3**). Their shapes and vertical positions are determined by which bits are turned on in their area of the player-missile area (see figures 2a and 2b). The fifth player enable bit only affects the color of the missiles.

You move a missile vertically the same way you move a player: by moving the missile-image data through their two bit-positions of the missile memory area. This can be difficult to do because missiles are grouped into the same memory table. To access a single missile, you must ignore the bits for the other missiles.

An important feature of player-missile graphics is that players and

missiles are completely independent of the playfield (ie: the text or graphics information also displayed by the computer). You can mix them with any text or graphics mode. This raises a problem: What happens if a player ends up on top of a playfield image? Which image has priority? You have the option to define the priorities used in displaying players.

Four priority schemes are possible (see the listing for register **PRIOR** in appendix B). If you wish, all players can have priority over all playfield color registers. Or you can set all playfield color registers (except background) to have priority over all players. Or you can set player 0 and player 1 (**P0** and **P1**) to have priority over all playfield color registers, with **P2** and **P3** having less priority than the playfield. Or you can set playfield color registers 0 and 1 (**PF0** and **PF1**) to have priority over all players, which then have priority over **PF2** and **PF3**. These priorities are selected with the priority control register (**PRIOR**) that is shadowed at **GPRIOR**. This capability allows a player to pass in front of one image and behind another, allowing three-dimensional effects.

Who Did I Just Hit?

The final embellishment is the provision for hardware collision detection. This is primarily of value for games. You can check if any graphics object (player or missile) has collided with anything else. Specifically, you can check for missile-player collisions, missile-playfield collisions, player-player collisions, and player-playfield collisions. There are fifty-four possible collisions, each one with a bit assigned to it that can be checked. If the bit is set, a collision has occurred. These bits are mapped into fifteen registers in **CTIA** (another custom integrated circuit in the Atari 400/800); only the lower 4 bits are used and some are not meaningful. These are read-only registers; they cannot be cleared by writing zeros to them. The registers can be cleared for further collision detection by writing any value to register **HITCLR**. All collision registers are cleared by this command.

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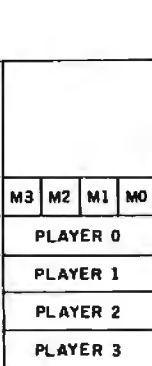
+ 1280

+ 1536

+ 1792

+ 2048

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DOUBLE-LINE
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PMBASE (MUST
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PMBASE + 384

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+ 768

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+ 1024



(2b)

THESE BITS GIVE THE SHAPE
AND VERTICAL POSITION FOR

MISSILE 3 MISSILE 2 MISSILE 1 MISSILE 0

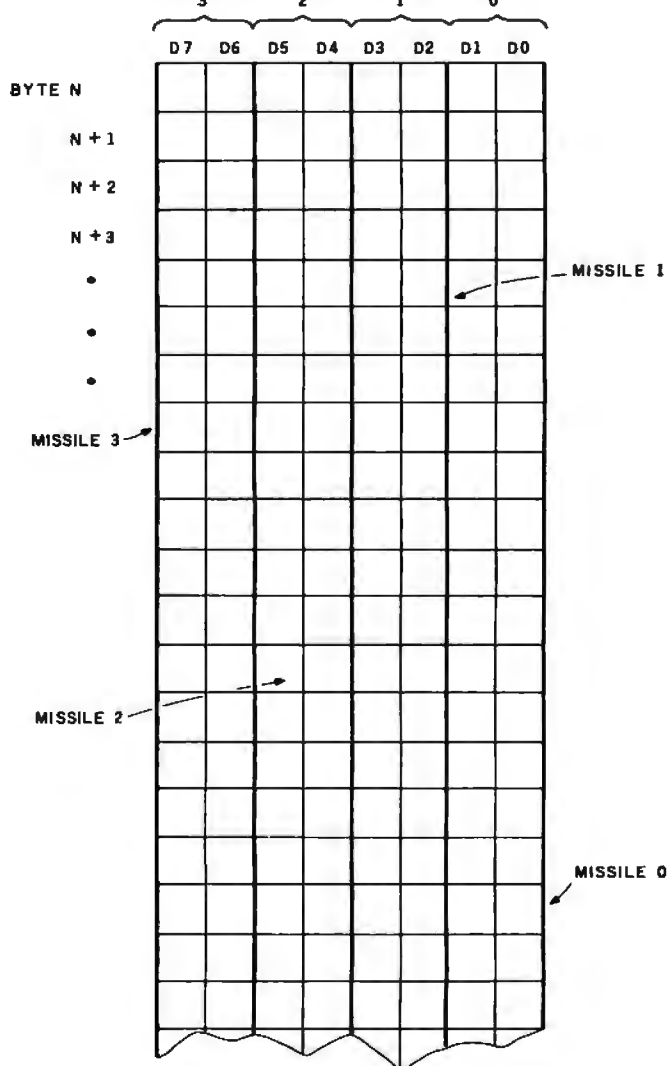


Figure 2: The player-missile area. Information on the shape and vertical position of the players and missiles is kept in a block of memory. The allocation for single-line and double-line player-missile areas is shown in figure 2a. Figure 2b shows how one area can store the shape and position of four missiles.

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In hardware terms, collisions occur when a player image coincides with another image. Thus, the collision bit will not be set until the part of the screen showing the collision is drawn. This means that collision detection might not occur until as many as 16 ms have elapsed since the player was moved. The preferred solution is to execute player motion and collision detection during the vertical-blank interrupt routine. In this case, collision detection should be checked first, then collisions cleared, then players moved. Another solution is to wait at least 16 ms after moving a player before checking for a collision involving that player.

Using Player-Missile Graphics

There are a number of steps necessary to use player-missile graphics. First, you must set aside an area of RAM (random-access read/write memory) as a player-missile area and tell the computer where it is. If you use single-line resolution, this area will be 1280 bytes long; if you use double-line resolution, it will be 640 bytes long. A good practice is to use the memory area in front of the display area at the top of the computer's available RAM. The layout of the player-missile area is shown in figure 2.

The pointer to the beginning of the player-missile area is labeled

Listing 2: An Atari BASIC program that draws a player on the screen and allows the user to move the figure with a joystick.

```

1 PMBASE=54279:REM
2 RAMTOP=106:REM
3 SDMCTL=559:REM
4 GRACLT=53277:REM
5 HPOSP0=53248:REM
6 PCOLR0=704:REM
10 GRAPHICS 0:SETCOLOR 2,0,0:REM
20 X=100:REM
30 Y=48:REM
40 A=PEEK(RAMTOP)-8:REM
50 POKE PMBASE,A:REM
60 MYPMBASE=256*A:REM
70 POKE SDMCTL,46:REM
80 POKE GRACLT,3:REM
90 POKE HPOSP0,100:REM
100 FOR I=MYPMBASE+512 TO
    MYPMBASE+640:REM
110 POKE I,0
120 NEXT I
130 FOR I=MYPMBASE+512+Y TO
    MYPMBASE+518+Y
140 READ A:REM
150 POKE I,A
160 NEXT I
170 DATA 8,17,35,255,32,16,8
180 POKE PCOLR0,88:REM
190 A=STICK(0):REM
200 IF A=15 THEN GOTO 190:REM
210 IF A=11 THEN X=X-1:POKE HPOSP0,X
220 IF A=7 THEN X=X+1:POKE HPOSP0,X
230 IF A<>13 THEN GOTO 280
240 FOR I=8 TO 0 STEP -1
250 POKE MYPMBASE+512+Y+I,PEEK
    (MYPMBASE+511+Y+I)
260 NEXT I
270 Y=Y+1
280 IF A<>14 THEN GOTO 190
290 FOR I=0 TO 8
300 POKE MYPMBASE+511+Y+I,PEEK
    (MYPMBASE+512+Y+I)
310 NEXT I
320 Y=Y-1
330 GOTO 190

```

player-missile base pointer
 OS top of RAM pointer
 RAM shadow of DMACTL register
 CTIA graphics control register
 horizontal position of P0
 shadow of player 0 color
 set background color to black
 BASIC's player horizontal position
 BASIC's player vertical position
 get RAM 2 K below top of RAM
 tell ANTIC where PM RAM is
 keep track of PM RAM address
 enable PM DMA with 2-line res
 enable PM display
 declare horizontal position

this loop clears player

this loop draws the player

make the player pink
 read joystick
 if inactive, try again

PMBASE. Because of internal limitations of the ANTIC device (a custom integrated circuit in the Atari computers), PMBASE must be on a 1 K-byte boundary for single-line resolution, or a 2 K-byte boundary for double-line resolution. If you elect

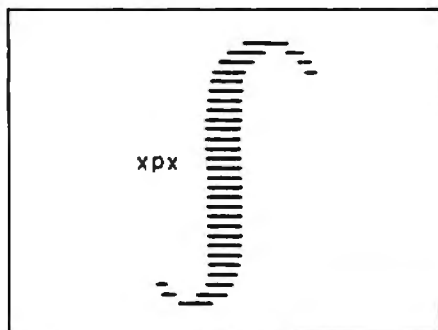


Figure 4: Use of a player as a special symbol. This can be done because players and missiles are superimposed over whatever text or graphics are in effect.

to use less than four players or none of the missiles, the areas of memory set aside for the unused objects may be used for other purposes. Once you decide where your player-missile area will be, you inform ANTIC of this by storing the page number of PMBASE into the PMBASE register in ANTIC.

The next step is to clear the player and missile areas by storing zeros into all locations in the player-missile memory area. Then draw the players and missiles by storing image data into the appropriate locations in the player-missile area.

Next, set the player parameters by setting the player color, horizontal position, and width registers to their initial values. If necessary, set the player/playfield priorities. Inform ANTIC of the vertical resolution desired by setting bit D4 of register DMACTL (shadowed at SDMCTL) for single-line resolution and clearing

the bit for double-line resolution. Finally, enable the players by setting the appropriate bits in DMACTL. Be careful not to disturb the other bits in DMACTL. A sample BASIC program for setting up a player and moving it with the joystick is given in listing 2.

Once players are displayed, they can be difficult to remove from the screen because the procedure by which they are displayed involves several steps. First, the ANTIC integrated circuit retrieves player-missile data from the player-missile area RAM (if such retrieval is enabled in the DMACTL register). Then ANTIC ships the player-missile data to the CTIA integrated circuit (if such action is enabled in the GRCTL register). CTIA displays whatever is in its player and missile graphics registers (GRAFP0 through GRAFP3 and GRAFM). Many programmers attempt to turn off player-missile graphics by clearing the control bits in DMACTL and GRCTL. This only prevents ANTIC from sending new player-missile data to CTIA; the old data in the GRAF(X) registers will still be displayed. To completely clear the players, the GRAF(X) registers must be cleared after the control bits in DMACTL and GRCTL have been cleared. A simpler solution is to leave the player up, but set its horizontal position to zero. Of course, if this solution is used, ANTIC will continue to use DMA to retrieve player-missile data, wasting roughly 10,000 machine cycles (about 10 ms) per second.

Uses

Player-missile graphics allow a number of special capabilities. They are of great value in animation. They do have limitations: there are only four players and each is only 8 bits wide. If you need more bits of horizontal resolution, you can always fall back on playfield animation. But for high-speed or quick-and-dirty animation, player-missile graphics work very well.

It is possible to bypass ANTIC and write player-missile data directly into the player-missile graphics registers (GRAFP(X)) in the CTIA integrated circuit. This gives the programmer

Listing 3: An Atari BASIC program to create a pseudoplayer with increased resolution. See the text and figure 3 for details.

1	RAMTOP = 106:REM	OS top of RAM pointer
2	PMBASE = 54279:REM	ANTIC player-missile RAM pointer
3	SDMCTL = 559:REM	shadow of DMACTL
4	GRCTL = 53277:REM	CTIA graphics control register
5	HPOSP0 = 53248:REM	horizontal position register of P0
6	PCOLR0 = 704:REM	shadow of player 0 color register
7	SIZEP0 = 53256:REM	player width control register
8	GPRIOR = 623:REM	priority control register
10	GRAPHICS 7	
20	SETCOLOR 4,8,4	
30	SETCOLOR 2,0,0	
40	COLOR 3	
50	FOR Y=0 TO 79:REM	this loop fills the screen
60	PLOT 0,Y	
70	DRAWTO 159,Y	
80	NEXT Y	
90	A = PEEK(RAMTOP) - 20:REM	must back up further for GR.7
100	POKE PMBASE,A	
110	MYPMBASE = 256 * A	
120	POKE SDMCTL,46	
130	POKE GRCTL,3	
140	POKE HPOSP0,100	
150	FOR I = MYPMBASE + 512 TO MYPMBASE + 640	
160	POKE I,255:REM	make player solid color
170	NEXT I	
180	POKE PCOLR0,88	
190	POKE SIZEP0,3:REM	set player to quadruple width
200	POKE GPRIOR,4:REM	set priority
210	COLOR 4	
220	FOR Y = 30 TO 40	
230	PLOT Y + 22,Y	
240	DRAWTO Y + 43,Y	
250	NEXT Y	

more direct control over player-missile graphics. As a result, it also increases his or her responsibilities. The programmer must maintain a bit-map of the player-missile data and move it into the graphics registers at the appropriate times. The 6502 must therefore be slaved (ie: synchronized to and triggered by) to the screen

drawing cycle. This is a clumsy technique that offers minor performance improvements in return for major programming efforts. The programmer who bypasses the hardware power offered by ANTIC must make up for it with his or her own sweat.

Player-missile graphics offer many capabilities in addition to animation.

Players are an excellent way to increase the amount of color in a display. The four additional color registers provided allow four more colors on each line of the display. Of course, the 8-bit resolution does limit the range of their application.

There is a way around this limitation that can sometimes be used. Take a player at quadruple width and put it onto the screen. Then set the priorities so the player has lower priority than a playfield color. Next, reverse that playfield color with background, so the apparent background color of the screen is really a playfield color. The player disappears behind this new false background. Cut a hole in the false background by drawing true background on it. The player will show up in front of the true background color, but only in the area where true background has been drawn. In this way, the player can have more than 8 bits of horizontal resolution. A sample program for doing this is given in listing 3. This program produces the display shown in figure 3.

Another application of player-missile graphics is for special characters. There are many special types of characters that cross vertical boundaries in normal character sets. One way to deal with these is to create special character sets that address this problem. Another way is to use a player. Subscripts, integral signs, and other special symbols can be done this way. A sample program for doing this is given in listing 4. This program produces the display shown in figure 4.

A particularly useful application of players is for cursors. With their ability to smoothly move anywhere over the screen without disturbing the contents, they are ideally suited for such applications. The cursor can change color as it moves over the screen to indicate what it has under it.

Player-missile graphics provide many capabilities. Their uses for action games as animated objects are obvious. They have many serious uses as well. They can add color and resolution to any display. They can present special characters. They can be used as cursors. Use them. ■

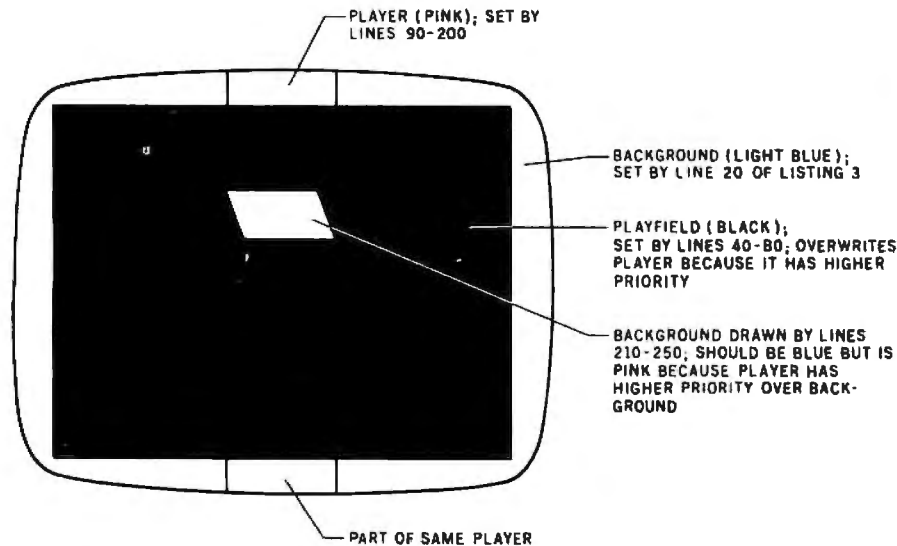


Figure 3: *Playing tricks with the video display to achieve higher player resolution. This technique works by manipulating the relative priorities of the playfield, players, and background. See the text and listing 3 for details.*

Listing 4: *An Atari BASIC program to create a player in the shape of an integral sign. See figure 4.*

```

1  RAMTOP = 106:REM
2  PMBASE = 54279:REM
3  SDMCTL = 559:REM
4  GRACCTL = 53277:REM
5  HPOSP0 = 53248:REM
6  PCOLR0 = 704:REM
10 GRAPHICS 0:A = PEEK(RAMTOP) -
16:REM
20 POKE PMBASE,A
30 MYPMBASE = 256*A
40 POKE SDMCTL,62
50 POKE GRACCTL,3
60 POKE HPOSP0,102
70 FOR I = MYPMBASE + 1024 TO
  MYPMBASE + 1280
80 POKE I,0
90 NEXT I
100 POKE PCOLR0,140
110 FOR I = 0 TO 15
120 READ X
130 POKE MYPMBASE + 1100 + I,X
140 NEXT I
150 DATA 14,29,24,24,24,24,24,24
160 DATA 24,24,24,24,24,24,184,112
170 ?" ":REM
180 POSITION 15,6
190 ?"x dx"

```

OS top of RAM pointer
 ANTIC player-missile RAM pointer
 shadow of DMACTL
 CTIA's graphics control register
 horizontal position register of P0
 shadow of player 0 color register

must back up for 1-line resolution

clear screen

Symbolic Name	Function	Hardware Register		Location	Hexa-decimal	Decimal	Symbolic Name	Shadow Register (if any)	Location		Hexa-decimal	Decimal
COLBK	Color Luminance of Background			D01A		53274	COLOR4				2C8	712
COLPF0	Color Luminance of Playfield 0			D016		53270	COLOR0				2C4	708
COLPF1	Color Luminance of Playfield 1			D017		53271	COLOR1				2C5	709
COLPF2	Color Luminance of Playfield 2			D018		53272	COLOR2				2C6	710
COLPF3	Color Luminance of Playfield 3			D019		53273	COLOR3				2C7	711
COLPM0	Color Luminance of Player-Missile 0			D012		53266	PCOLR0				2C0	704
COLPM1	Color Luminance of Player-Missile 1			D013		53267	PCOLR1				2C1	705
COLPM2	Color Luminance of Player-Missile 2			D014		53268	PCOLR2				2C2	706
COLPM3	Color Luminance of Player-Missile 3			D015		53269	PCOLR3				2C3	707
DMACTL	Direct Memory Access (DMA) Control			D400		54272	SDMCTL				22F	559
GRCTL	Graphic Control			D01D		53277						
GRAFM	Graphics for all Missiles			D011		53265						
GRAFP0	Graphics for Player 0			D00D		53261						
GRAFP1	Graphics for Player 1			D00E		53262						
GRAFP2	Graphics for Player 2			D00F		53263						
GRAFP3	Graphics for Player 3			D010		53264						
HITCLR	Collision Clear			D01E		53278						
HPOSM0	Horizontal Position of Missile 0			D004		53252						
HPOSM1	Horizontal Position of Missile 1			D005		53253						
HPOSM2	Horizontal Position of Missile 2			D006		53254						
HPOSM3	Horizontal Position of Missile 3			D007		53255						
HPOSP0	Horizontal Position of Player 0			D000		53248						
HPOSP1	Horizontal Position of Player 1			D001		53249						
HPOSP2	Horizontal Position of Player 2			D002		53250						
HPOSP3	Horizontal Position of Player 3			D003		53251						
MOPF	Missile 0 to Playfield Collisions			D000		53248						
M0PL	Missile 0 to Player Collisions			D008		53256						
M1PF	Missile 1 to Playfield Collisions			D001		53249						
M1PL	Missile 1 to Player Collisions			D009		53257						
M2PF	Missile 2 to Playfield Collisions			D002		53250						
M2PL	Missile 2 to Player Collisions			D00A		53258						
M3PF	Missile 3 to Playfield Collisions			D003		53251						
M3PL	Missile 3 to Player Collisions			D00B		53259						
P0PF	Player 0 to Playfield Collisions			D004		53252						
P0PL	Player 0 to Player Collisions			D00C		53260						
P1PF	Player 1 to Playfield Collisions			D005		53253						
P1PL	Player 1 to Player Collisions			D00D		53261						
P2PF	Player 2 to Playfield Collisions			D006		53254						
P2PL	Player 2 to Player Collisions			D00E		53262						
P3PF	Player 3 to Playfield Collisions			D007		53255						
P3PL	Player 3 to Player Collisions			D00F		53263						
PMBASE	Player Missile Base Address			D407		54279						
PRIOR	Priority Select			D01B		53275	GPRIOR				28F	623
SIZEM	Sizes for all Missiles			D00C		53260						
SIZEP0	Size of Player 0			D008		53256						
SIZEP1	Size of Player 1			D009		53257						
SIZEP2	Size of Player 2			D00A		53258						
SIZEP3	Size of Player 3			D00B		53259						



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Appendix B: Functional Specification of Selected Atari 400/800 Hardware Registers

The following charts give the functions of the registers listed in Appendix A on a bit-by-bit basis. Although this information is not necessary to the understanding of the article, it is given for the benefit of advanced programmers who want to exercise complete control over the player-missile graphics. This information is excerpted from the *Atari Personal Computer System Operating System User's Manual and Hardware Manual* (part C016555), which contains complete technical information on this and other aspects of the Atari 400 and 800 computers. This user's manual can be purchased from Atari Customer Service, 1346 Bordeaux Dr, Sunnyvale CA 94086; the price is \$27 plus \$3 shipping and handling (California residents must add 6½% tax).

COLBK (Background Color): This address writes data to the Background Color-Luminance Register.

Color				Luminance			Not Used
D7	D6	D5	D4	D3	D2	D1	
X	X	X	X	0	0	0	Zero Luminance (black)
(see below)				0	0	1	
					etc		
				1	1	1	Max. Luminance (white)
0	0	0	0	Grey			
0	0	0	1	Gold			
0	0	1	0	Orange			
0	0	1	1	Red-Orange			
0	1	0	0	Pink			
0	1	0	1	Purple			
0	1	1	0	Purple-Blue			
0	1	1	1	Blue			
1	0	0	0	Blue			
1	0	0	1	Light-Blue			
1	0	1	0	Turquoise			
1	0	1	1	Green-Blue			
1	1	0	0	Green			
1	1	0	1	Yellow-Green			
1	1	1	0	Orange-Green			
1	1	1	1	Light-Orange			

Shadow Register: COLOR4

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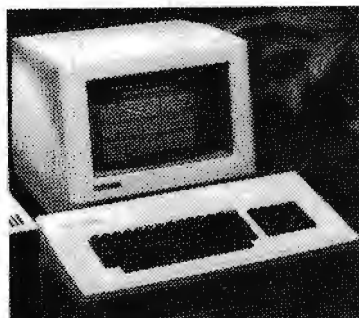
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COLPF0—COLPF3 (Playfield Color): These addresses write data to the Playfield Color-Luminance Registers.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

(see COLBK for bit assignment)

Shadow Registers: COLOR0—3

COLPM0—COLPM3 (Player-Missile Color): These addresses write to the Player-Missile Color-Luminance Registers. Missiles have the same color luminance as their player unless missiles are used as a fifth player (see bit 4 of PRIOR). A fifth player missile gets its color from register COLPF3.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

(see COLBK for bit assignments)

Shadow Registers: PCOLR0—3

DMACTL (Direct Memory Access Control): This address writes data into the DMA Control Register.

Not Used	D5	D4	D3	D2	D1	D0
----------	----	----	----	----	----	----

- D5 = 1 Enable ANTIC operation (must be set to 1)
- D4 = 1 1 line Player/Missile resolution
- D4 = 0 2 line Player/Missile resolution
- D3 = 1 Enable Player DMA
- D2 = 1 Enable Missile DMA
- D1,D0 = 0 0 No Playfield DMA
- = 0 1 Narrow Playfield DMA (128 Color Clocks)
- = 1 0 Standard Playfield DMA (160 Color Clocks)
- = 1 1 Wide Playfield DMA (192 Color Clocks)

See GRACTL. Shadow Register: SDMCTL, default value hexadecimal 22

GRACTL (Graphics Control): This address writes data to the Graphic Control Register.

Not Used	D1	D0
----------	----	----

- D1 = 1 Enable Player DMA to Player Graphics Registers.
- D0 = 1 Enable Missile DMA to Missile Graphics Registers.

DMA is enabled by setting bits in both DMACTL and GRACTL. Setting DMACTL only will result in cycles being stolen, but no display will be generated.

GRAFM (Missile Graphics Registers): This address writes data directly into the Missile Graphics Register, independent of DMA. This is a bit-map of the current scan line of all four missiles. It is automatically maintained by the normal use of player-missile graphics.

D7	D6	D5	D4	D3	D2	D1	D0
L	R	L	R	L	R	L	R
M3		M2		M1		M0	

Missile Number

GRAFP0—GRAFP3 (Player Graphics Registers): These addresses write data directly into the Player Graphics Registers, independent of DMA. This is a bit-map of the current scan line for a given player. It is automatically maintained by the normal use of player-missile graphics.

D7	D6	D5	D4	D3	D2	D1	D0
Left				Right			
Player on TV Screen							

HITCLR (Collision "HIT" Clear): Writing to this address clears all collision bits in all the collision registers.

Not Used

HPOSM0—HPOSM3 (Missile Horizontal Position): These addresses write data into the Missile Horizontal Position Registers (see HPOSP0 description below).

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

HPOSP0—HPOSP3 (Player Horizontal Position): These addresses write data into the Player Horizontal Position Register. The horizontal position value determines the color clock location of the left edge of the object. Hexadecimal 30 is the left edge of a standard-width screen. Hexadecimal D0 is the right edge of a standard-width screen.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

M0PF, M1PF, M2PF, M3PF (Missile-to-Playfield Collisions): These addresses read missile-to-playfield collisions. A 1 bit means that a collision has been detected since the last HITCLR.

Not Used (forced to zero)	D3	D2	D1	D0
	3	2	1	0

Playfield Type

M0PL, M1PL, M2PL, M3PL (Missile-to-Player Collisions): These addresses read missile-to-player collisions.

Not Used (forced to zero)	D3	D2	D1	D0
	3	2	1	0

Player Number

P0PF, P1PF, P2PF, P3PF (Player-to-Playfield Collisions): These addresses read player-to-playfield collisions.

Not Used (forced to zero)	D3	D2	D1	D0
	3	2	1	0

Playfield Type

P0PL, P1PL, P2PL, P3PL (Player-to-Player Collisions): These addresses read player-to-player collisions.

Not Used (forced to zero)	D3	D2	D1	D0
	3	2	1	0

Player Number

(Player *n* against player *n* is always a zero.)

PMBASE (Player-Missile Address Base Register): This address writes data into the Player-Missile Address Base Register. The data specify the most-significant bits of the address of the beginning of the player-missile area.

One-Line Resolution

D7	D6	D5	D4	D3	not used	PMBASE
----	----	----	----	----	----------	--------

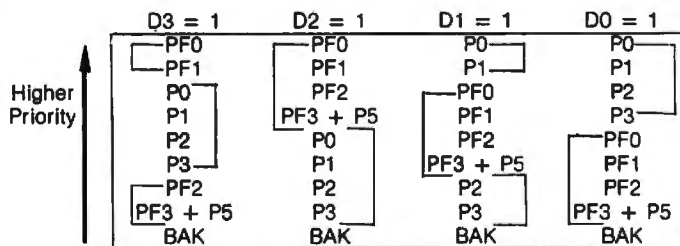
Two-Line Resolution

D7	D6	D5	D4	D3	D2	not used	PMBASE
----	----	----	----	----	----	----------	--------

PRIOR (Priority Register): This address writes data into the Priority Control Register.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

- D7—D6 Set to zero.
D5 *Multiple Color Player Enable* This bit set to 1 causes the logical "or" function of the bits of the colors of Player 0 with Player 1, and also of Player 2 with Player 3. This permits overlapping the position of two players with a choice of three colors in the overlapped region.
D4 *Fifth Player Enable* This bit causes all missiles to assume the color of Playfield Type 3. (COLPF3). This allows missiles to be positioned together with a common color for use as a fifth player.
D3—D0 *Priority Select* Only one of these 4 bits can be a 1. These bits select one of four types of priority. Objects with higher priority will appear to move in front of objects with lower priority.



P_n = player n
 PF_n = playfield n
BAK = background
+ = logical or (PF_3 and P_5 are always same color)

Note: The use of priority bits in a "nonexclusive" mode (more than one bit set to 1) will result in objects whose priorities are in conflict turning *black* in the overlap region.

Example: PRIOR code = 1010: This will black out P0 or P1 if they are over PF0 or PF1. It will also black out P2 or P3 if they are over PF2 or PF3. In the one-color 40-character (playfield) modes, the *luminance* of a pixel in a character is determined by COLPF1, regardless of the priority. If a higher-priority player or missile overlaps the character, the *color* is determined by the player's color.

Shadow Register: GPRIOR

SIZEM (Missile Size): This address writes data into the Missile Size Control Register.

D7	D6	D5	D4	D3	D2	D1	D0
M3		M2		M1		M0	

Horizontal Size
Register (Missile)

0	0	Normal Size (total of 2 color clocks wide)
0	1	Twice Normal Size (total of 4 color clocks wide)
1	0	Normal Size
1	1	Four Times Normal Size (total of 8 color clocks wide)

SIZEP0—SIZEP3 (Player Size): These addresses write data into the Player Size Control Registers.

Not Used	D1	D0
	0	0
	0	1
	1	0
	1	1

Horizontal Size
Register (Player)

Normal Size (total of 8 color clocks wide)
Twice Normal Size (total of 16 color clocks wide)
Normal Size
Four Times Normal Size (total of 32 color clocks wide)

With normal-size objects, each bit in the graphics register corresponds to one color clock. This makes an 8-bit wide player 8 color clocks wide. For larger objects, each bit is extended over more than one color clock.

machine-language program simply counts how many times this signal is present.

The human voice contains more than single tones, of course, and there will be frequent zero crossings. Therefore, any program you use must be able to count at a high rate as well as look at all the filters. Such speed can only be accomplished with a machine-language program.

There have been various articles on speech recognition in a number of magazines, and I'm sure you will be seeing more in the future. I have a few designs on the drawing board for a speech-recognition circuit. I will unveil one in a "Circuit Cellar" article as soon as it works well enough.

Keep up your interest, and perhaps we'll both be talking to our computers soon. . . . Steve

What's In a ROM?

Dear Steve,

I would like to do some game programming for an Atari video game, but I don't know what type of ROM (read-only memory) is used. Can you help me, or do you know where I can get the schematics for an Atari game?

Frank Weatherford
Gray TN

Atari games generally consist of either 4 K- or 8 K-byte ROM packs. One of the pre-release ROM packs that I received had 2732 EPROMs (erasable programmable read-only memories) in it. This would imply that you could substitute 2716 or 2732 EPROMs in most cases. I have known some people who have taken ROMs out of

inexpensive game packs and replaced them with their own software. . . . Steve

Home-Control Design

Dear Steve,

I would like to ask you for some help. A friend of mine is a quadriplegic who has great difficulty when he is home alone. Because he is unable to type, a voice-operated system is most desirable. If you could design a system, he could get someone to install it.

Jonathan Shaw
Tampa FL

You'll forgive me, of course, for not wishing to design a system specifically for you. That is a tremendous undertaking which could take months, even years, of

work. Instead, I recommend that you contact Artra Inc. This company makes an interface card called House-master. I have tried it, and it works reasonably well.

The company's address is Artra Inc., 4424 Vacation Ln., Arlington VA 22207, (703) 527-0455. The interface sells for under \$300 and incorporates tone generators, a BSR X-10 AC remote-control section, and a voice-response system. It attaches directly to Digital Group and Heath H-89 computers, but it can be adapted to work with many others. Using this system, it would be possible for your friend to turn on the lights with a voice command. . . . Steve

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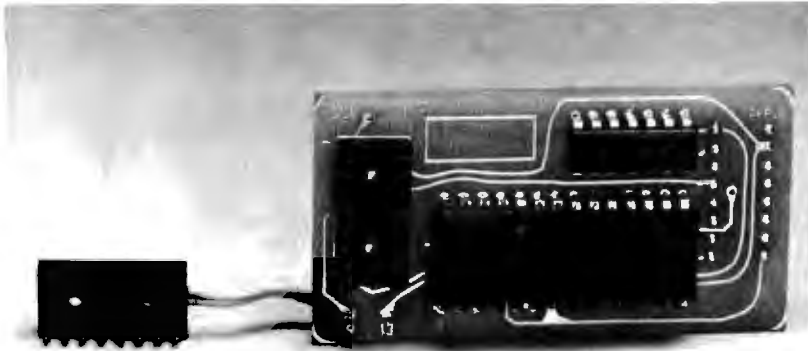
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What's New?

MISCELLANEOUS



Type-Ahead Buffer

The Model 150 Type-Ahead Buffer for the Apple II features a 40-character type-ahead capability. It eliminates the need to wait for computer prompts before entering the next command or data. No software patches, circuit board cuts, or jumpers are required. The Model 150 costs \$49.95 and is available from Vista Computer Company, 1317 E Edinger, Santa Ana CA 92705, (714) 953-0523.

Circle 550 on Inquiry card.



64 K-Bit ROM

GTE's 2364 is a 64 K-bit ROM (read-only memory) with an automatic power-down feature that reduces power requirements. The device operates with a 40 mA current in the active mode and an 8 mA current in the standby mode. It uses a single +5 V supply.

The 2364 is organized as an 8 K-byte by 8-bit unit. The device has access times of 250 and 300 ns. All inputs and outputs are TTL- (transistor-transistor logic) compatible.

In lots of 250, the 300 ns 2364 ROM costs \$21.20. Contact GTE Microcircuits Division, 2000 W 14th St, Tempe AZ 85281, (602) 968-4431.

Circle 548 on Inquiry card.

A Modem for the Atari

The Microconnection is an answer/originate, direct-connect modem for Atari 400 and 800 computers. The Microconnection features autodial/autoanswer operation (optional), which allows an unattended Atari to send messages, text, or other data to a host computer, and automatically answer the telephone and receive data, too.

The Microconnection is Bell 103 compatible and operates at 300 bps (bits per second). Models are available for use without the Atari 850 interface and provide a socket for connection to any serial printer capable of 300 bps operation. A cassette recorder can be plugged into the unit for storage and playback of received data.

With autodialing terminal software, power supply, and a cable, the Microconnection costs \$199.50. The autodial/autoanswer option is \$79 extra. For complete details, contact the MicroPeripheral Corporation, 2643 151st Pl, NE, Redmond WA 98052, (206) 881-7544.

Circle 549 on Inquiry card.

FORTH for the Apple

TransFORTH II is a fully compiled, floating-point implementation of fig-FORTH for Apple II, II Plus, or III microcomputers. It has transcendental functions, strings and arrays, high- and low-resolution graphics, Turtlegraphics, and music.

TransFORTH II has a suggested price of \$125. For details, contact Insoft, 259 Barnett Rd, Unit #3, Medford OR 97501, (503) 779-2465.

Circle 551 on Inquiry card.

Articles and Papers Compilation

The Battelle Memorial Institute has a booklet listing the titles of papers and articles from its staff. The booklet contains the names and dates of the publications in which an article or paper appeared and the author(s).

Copies of the booklet, entitled *Published Papers and Articles: 1980*, are free from the Reprint/Brochure Center, Battelle Memorial Institute, 505 King Ave, Columbus OH 43201, Attn: Jane Carr, (614) 424-7727. Battelle is an independent research and development institute.

Circle 552 on Inquiry card.

Arcade

Gregg Williams, Senior Editor

4



5



the ship in the middle, and you try to last as long as possible against kamikaze ships that are battering your shields. You can shoot past your shields at the enemy ships, but they are very hard to hit. *Space Warrior*, by Marc Goodman, for the Apple II or II Plus, \$24.95 (disk), from Broderbund Software, 2 Vista Wood Way, San Rafael, CA 94901.

4 *Apple Panic* is one of the most creative and novel games to be invented for a microcomputer. The small creatures after you are "apples," and you have only one way of stopping them. You must dig holes in the walkway you are on; when an "apple" falls into one and is temporarily stuck there, you must knock it through before it can get out of the hole and repair the walkway. Unlike so many arcade games that can often defeat you in less than a minute, this game is slow paced and easy to play (although it is still challenging). *Apple Panic*, by Ben Serki, for the Apple II or II Plus, \$29.95 (disk), from Broderbund Software, 2 Vista Wood Way, San Rafael, CA 94901.

5 *Kayos* is an assault on the senses. While a field of asteroids distracts your eyes and two colored air-

6



craft (middle) try to ram your ship (at bottom), your objective is to shoot the quickly moving red ship zooming across the top of the screen. *Kayos*, for any Atari 400/800, \$34.95 (disk or cassette), from Computer Magic Ltd, 176 Main St, Port Washington NY 11050.

6 The classic game *Galactic Empire* has recently been translated for the Atari 400 and 800 computers. In this free-form game of military strategy, you command the flagship Orion and must use your limited resources to conquer and hold the twenty inhabited planets of the known galaxy. *Galactic Empire*, by Douglas Carliston (Atari translation by David Simmons), for the Atari 400/800, \$19.95 (cassette), from Adventure International, POB 3435, Longwood FL 32750.



2 Earth is a battleground! You must patrol the skies, shoot down strange creatures that materialize from thin air, and rescue humans that are being abducted by a mysterious blue-winged creature. This game, loosely based on the Williams Defender coin-operated game, has the most breathtaking graphics I've seen to date! Gorgon, by Nasir Gebelli, for the Apple II or II Plus, \$39.95 (disk), from Sirius Software, 2011 Arden Way #225A, Sacramento CA 95825.



3 Most microcomputer games that are versions of existing board or equipment games aren't worth the disks they're printed on, but Raster Blaster does not fall into that category! Ignore the totally realistic ball movement if you want to, but the robot arms that can hold a ball in play for later release are a feature that no



3



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existing pinball machine can match. Raster Blaster, by Bill Budge, for the Apple II or II Plus, \$29.95 (disk), from BudgeCo, 428 Pala Avenue, Piedmont CA 94611.

4 Missile Command, one of the most popular coin-operated arcade games to date, is now available in a cartridge for the Atari 400 or 800 computers. The trackball of the coin-operated version has been replaced by an Atari joystick, and you have only one missile base (not three), but the sights, sounds, and behavior of the original game are still there. Missile Command, for the Atari 400/800 computer, \$39.95 (cartridge), from Atari Inc, Consumer Division, 1195 Borregas Ave, Sunnyvale CA 94086.

5 This night-driving game features five Grand Prix-type racetracks, manual or automatic conditions, sound, varying road conditions, and several other options. The graphics and human engineering on this game are very good. International Grand Prix, by Richard Orban, for the Apple II or II Plus, \$30.00 (disk), from Riverbank Software Inc, POB 128, Smith's Landing Road, Denton MD 21629.

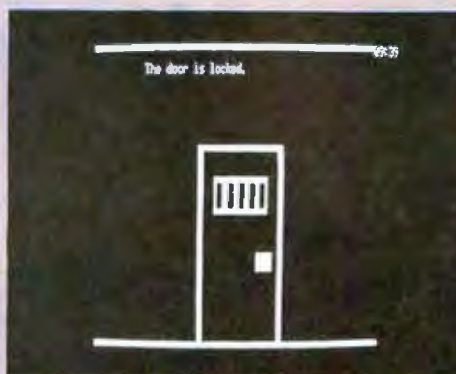
4



5



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5 "From darkest dungeons to deepest space!" This extravagant claim is fulfilled by the game *Ultima*, a graphics-oriented role-playing game. The game takes place in several locations—outdoors (shown here) and in space, a three-dimensional dungeon, and a castle. *Ultima*, by Lord British, for the Apple II or II Plus, \$39.95 (disk), from California Pacific Computer Co, 1623 Fifth St, Davis CA 95616.

6 Even though you're in the *Asylum*, they are trying to kill you, and you have until morning to get out! *Asylum* is an adventure game (that is, a puzzle to be solved) with graphics, full-sentence commands, and a real-time clock that gives you a deadline for getting out. Not only is it a devious game, it is a very good buy for the money. *Asylum*, by Frank Corr, Jr and William Denman, Jr, for the Radio Shack TRS-80 Models I and III, \$14.95 (cassette), \$19.95 (disk), from Med Systems Software, POB 2674, Chapel Hill NC 27514.

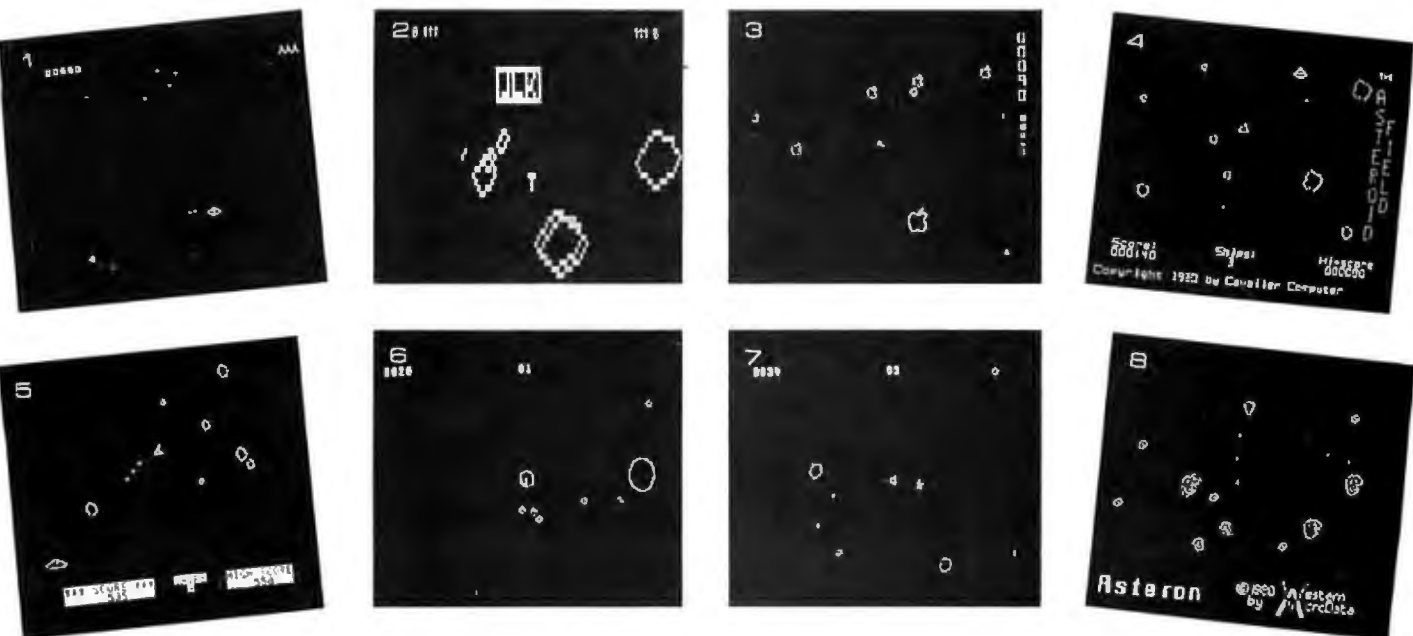
Games For Experts

4 *Eastern Front* (1941) is possibly the first fun war game for people who hate war games. The playing screen is several times larger than the video-display window—but you can see the entire map by smoothly scrolling the window across it! Also, the map changes with the seasons, the game has no charts or tables (the computer does all the calculations automatically), and

there are no long waits for the computer to finish a move (it does its calculations while you are entering your moves). *Eastern Front* (1941), by Chris Crawford, for the Atari 400 or 800 computers, \$26.95 (cassette) or \$29.95 (disk) plus \$2.50 shipping and handling, from the Atari Program Exchange, POB 427, 155 Moffett Park Dr, Sunnyvale CA 94086.

Battle of the Asteroids

Gregg Williams, Senior Editor



1: Planetoids, from Adventure International; 2: Super Nova, from Big Five Software; 3: Apple-oids, from California Pacific Computer Co; 4: The Asteroid Field, from Cavalier Computer; 5: Meteoroids in Space, from Quality Software; 6: Bubbles, from Softape; 7: Planetoids, from Softape; 8: Asteron, from Western MicroData Enterprises, Ltd.

If imitation is the sincerest form of flattery, then the people who designed Atari's coin-operated video game Asteroids have a lot to be proud of. Asteroids is one of the most successful commercial games around (equaled or surpassed only by Midway's Space Invaders and a newer Atari game, Missile Command) and has its own sequel (Asteroids Deluxe, also by Atari). Its popularity has inspired numerous imitations for use with personal computers. With so many versions around, the only dilemma is which one to buy.

I gathered every Asteroids-like game I could find (all but one were for the Apple II) and created a chart that shows you which version does what. Some notes to keep in mind: all Apple disk versions boot on either DOS 3.2 or 3.3 systems; unless noted in the table, versions with sound have no way of turning it off (important when playing late at night); all the games (except Apple-oids)

give a black-and-white-only display; all of the versions are, in their own way, entertaining and well done; and none of the games (except possibly The Asteroid Field) looks or works *exactly* like the arcade original. Also keep in mind that two of these Asteroids-like games (Apple-oids and Bubbles/Planetoids) give you an extra game in the package price; this certainly influences how much game you get for your money. ■

See pages 164-165 for the comparison chart.

Asteroids is a trademark of Atari, Inc. The game is available in two coin-operated versions and cartridges for the Atari Video Computer System (game-cartridge system) and the Atari Personal Computer System (the Atari 400 and 800 microcomputers).

Product Name	Manufacturer	Price	Computer Used	Levels of Play	Ships per Game	Method of Firing
Planetoids	Adventure International POB 3435 Longwood FL 32750	\$19.95 (disk), \$14.95 (cassette that loads to disk)	Apple II or II Plus with 32 K bytes of memory and one disk drive	three: easy (asteroids explode each other), regular, hard (asteroids attracted to ship)	four	any key
Super Nova	Big Five Software POB 9078-185 Van Nuys CA 91409	\$17.95 (Model I disk version), \$15.95 (Model III/cassette version)	Radio Shack TRS-80 Model I or III (disk and 32 K bytes of memory for disk version, 16 K bytes of memory for cassette version)	one	three	P key
Apple-oids (part of Apple-oids game package)	California Pacific Computer Co 1623 Fifth St Davis CA 95616	\$29.95	Apple II or II Plus with 32 K bytes of memory and one disk drive	one	three	0 through 9 keys (identical in function)
The Asteroid Field	Cavalier Computer POB 2032 Del Mar CA 92014	\$24.95	Apple II or II Plus with 32 K bytes of memory and one disk drive	two	Five (easy level of play) or three (expert level)	several: forward arrow, paddle button 0 or 1; see notes
Meteoroids in Space	Quality Software 6660 Reseda Blvd Suite 105 Reseda CA 91335	\$19.95	Apple II or II Plus with 32 K bytes of memory and one disk drive	one (but many variations influence difficulty)	five	autofire (bursts of fire come automatically from ship) or space bar for manual firing
Bubbles (part of Baker's Trilogy)	Softape 10432 Burbank Blvd North Hollywood CA 91601	\$29.95 for a disk containing Bubbles, Planetoids, and a racing game called Burnout	Apple II or II Plus with 32 K bytes of memory and one disk drive	one	three	paddle button 0
Planetoids (part of Baker's Trilogy)	Softape 10432 Burbank Blvd North Hollywood CA 91601	\$29.95 for a disk containing Bubbles, Planetoids, and a racing game called Burnout	Apple II or II Plus with 32 K bytes of memory and one disk drive	one	three	ship fires automatically during game (no player control over firing)
Asteron	Western MicroData Enterprises Ltd. POB G33 Postal Station G Calgary, Alberta T3A 2G1 Canada	\$29.95	Apple II or II Plus with 48 K bytes of memory and one disk drive	one	three	space bar

Method of Turning Ship	Method of Moving Ship	Hyper-space Available?	Sound Effects?	Number and Kind of Enemy Ships	Notes	Overall Impression
paddle 0	paddle button 0 causes movement until button released	no	yes	two kinds of enemy ships that shoot back	•See May 1981 BYTE, page 116, for a full review. •Hard level of play is too hard—ships get destroyed as soon as they appear.	•An interesting Asteroids-like game.
T and R keys, to rotate ship one-eighth turn clockwise and counter-clockwise, respectively	O key causes movement until key released	yes (space bar)	no	five kinds of enemy ships that shoot back (with varying degrees of intelligence)	•See May 1981 BYTE, page 108, for a full review.	•The best TRS-80 Asteroids-like game I've seen.
paddle 1	paddle button 1 causes movement until button released	yes (any key except 0 through 9)	yes	two kinds of enemy ships that shoot back (enemy ships are colored yellow)	•A nice feature is that your ship rotates three complete turns for the full paddle movement; this prevents rotation problems when you are near the end of the paddle rotation.	•A good version of Asteroids (but the asteroids are shaped like apples—strange!) •Includes a Break-out-like game that is also very good. •A nice set of games for the price.
several: D and F keys, paddle 0; see notes	several: back arrow, paddle button 1; see notes	yes (space bar); screen flashes to denote hyper-space jump—a nice touch	yes (including an accelerating "thump-thump" sound as found in Space Invaders)	two kinds of enemy ships that shoot back (size and shape same as in coin-operated game)	•Game gives four options for ship control: one keyboard-only option and three that use keyboard and/or paddles. •Sound effects cannot be turned off. •Control-C inverts playfield to black on white.	•Many options make this game very easy to play. •Display is flicker-free. •Game play is closest to coin-operated version of all versions listed here. •Easily the best Apple Asteroids-like game I've seen.
P, RETURN keys (manual turn), arrow keys (auto-matic turn), or paddle 0	Z key or paddle button 0; ship can use "auto brake" (moving ship does not coast indefinitely) or not	yes (asterisk key)	yes (including an accelerating "thock-thock" sound as found in Space Invaders)	one kind of ship that shoots back (and is very accurate)	•An updated version of Asteroids in Space (reviewed on page 116 of the May 1981 BYTE). •Good placement of keys for keyboard version.	•A very good Asteroids-like game (although it is not exactly like the original). •Game has five sets of options; different combinations give several levels of difficulty.
paddle 0	none; hexagonal ship is fixed in center of screen	no	yes	no enemy ships	•Bubbles bounce back from the top and bottom edges of the screen. •Smallest bubbles are very small but still dangerous.	•An interesting variation of Asteroids.
paddle 0	paddle button 0 causes movement that continues until an opposite thrust is applied	yes (any key)	yes	no enemy ships	•Planetoids are pentagons that come in four sizes. •Game gives extra points for "docking" (running over) with "stars" that decrease in size and vanish.	•An interesting variation of Asteroids.
paddle 0 or Q,U,W,I,E,O, R,P keys	button on paddle 0 (or C and M keys) causes movement that continues until an opposite thrust is applied	yes (hit any number key)	yes; may be turned on and off with control-Q	one kind of enemy ship that shoots back	•All figures on the screen flicker slightly. •Player must hit S key with each new ship to start (or restart) game.	•A mediocre implementation; it is awkward to use and has no interesting features to compensate.

The Atari Tutorial

Part 4: Display-List Interrupts

Chris Crawford
1272 Borregas Ave
Sunnyvale CA 94086

The display-list interrupt is one of the most powerful features built into the Atari personal computer system. It is also one of the least accessible features of the system, requiring of the programmer a firm understanding of assembly language as well as all of the other characteristics of the machine. Used alone, display-list interrupts provide no additional capabilities; they must be used in conjunction with the other features of the system, such as player-missile graphics, character-set indirection, or color-register indirection. With display-list interrupts, the full power of these features can be realized.

Display-list interrupts take advantage of the sequential nature of the raster-scan television display. The television draws the screen image in a time sequence, from the top of the screen to the bottom. This drawing process takes about 13,000 microseconds and looks instantaneous to the human eye. But that is a long time in comparison to the time scale the computer works in. The computer has plenty of time to change the parameters of the screen display

while it is being drawn. Of course, the computer must make each change each time the screen is drawn, which happens 60 times per second. Also (and this is the tricky part), it must change the parameter in question at exactly the same moment each time the screen is drawn. That is, the cycle of changing screen parameters must be synchronized to the screen-drawing cycle. One way to do this might be to lock the 6502 micro-

With display-list interrupts, many key Atari registers can be changed during the drawing of a single screen-display frame.

processor into a tight timing loop with an execution frequency of exactly 60 hertz. This would make it very difficult for the computer to do anything other than the screen-display computations. It would also be a tedious job. A much better way is to interrupt the 6502 just before the time has come to change the screen parameters. The 6502 responds to the interrupt, changes the screen parameters, and returns to its normal

business. The interrupt to do this must be precisely timed to occur at exactly the same point during the screen-drawing process. This specially timed interrupt is provided by the ANTIC integrated circuit within the Atari 400/800; it is called a *display-list interrupt* (DLI).

The timing and execution of any interrupt process can be intricate; therefore, I shall first describe the sequence of events in a properly working display-list interrupt. The process begins when the ANTIC chip encounters a display-list instruction having its interrupt bit (bit D7) set. ANTIC waits until the last scan line of the mode line it is currently displaying. ANTIC then refers to its NMIEEN (nonmaskable interrupt enable) register (hexadecimal location D40E) to see if display-list interrupts have been enabled. If the enable bit (bit D7) is cleared (to a logic 0), ANTIC ignores the interrupt and continues its regular tasks. If the enable bit is set (to a logic 1), ANTIC "pulls down" the NMI (nonmaskable interrupt) line on the 6502, signaling an interrupt. ANTIC then goes back to its normal display activities. The 6502 starts executing an interrupt-service routine pointed to by the NMI vector in the operating system. This routine first determines the cause of the inter-

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rupt. If the interrupt is indeed a display-list interrupt, control is transferred indirectly by means of the 16-bit address contained in hexadecimal locations 0200 and 0201 (low byte first) to a DLI-service routine. The DLI routine changes one or more of the graphics registers controlling the display. The 6502 then returns from the interrupt routine to resume its mainline program.

Creating a Display-List Interrupt

A number of steps are involved in setting up a display-list interrupt. The

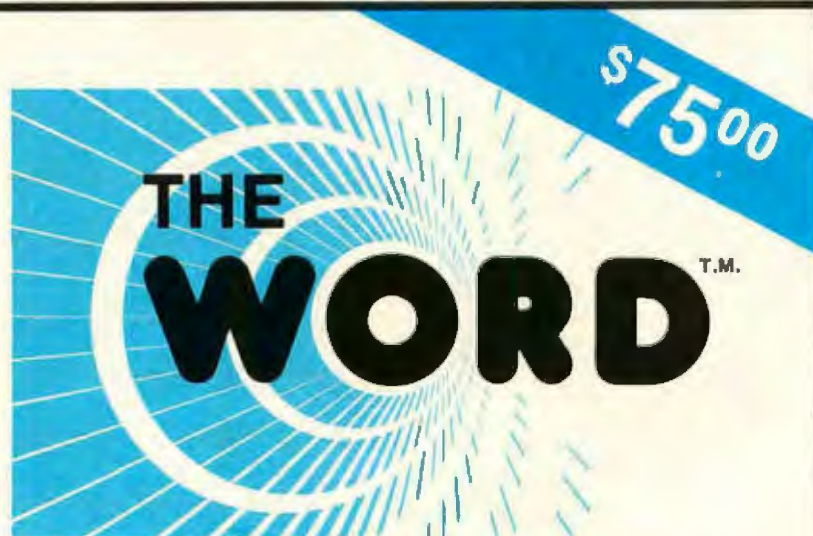
first thing you must do is write the DLI routine itself. The routine must start by pushing any 6502 registers that will be altered onto the stack, because the operating system interrupt-poll routine itself saves no registers. (The 6502 status register is automatically pushed onto the stack.) The routine should be short and fast; it should change only those registers related to the display; and it should end by restoring any 6502 registers pushed onto the stack.

Next, you must place the DLI-service routine somewhere in

memory. Page six (hexadecimal addresses 600 to 6FF) is an ideal place. Set the vector at hexadecimal locations 0200 and 0201 to point to your routine. Determine the vertical point on the screen where you want the DLI to occur, and then go to the corresponding display-list instruction and set bit D7 of the *previous* instruction. Finally, enable the DLI by setting bit D7 of the NMIE register at hexadecimal location D40E. The DLI will begin executing immediately.

As with any interrupt-service routine, timing considerations can be critical. ANTIC does not send the interrupt to the 6502 immediately upon encountering an interrupt instruction; it delays doing this until the last scan line of the interrupting mode line. The 6502 and the interrupt-service routine in the operating system together consume 33 machine cycles. Thus, the first instruction of your DLI-service routine will not be reached until 33 machine cycles have elapsed in the last scan line of the interrupting mode line. Thirty-three machine cycles corresponds to 66 color clocks on the screen. Thus, your DLI-service routine will begin executing while the electron beam is partway across the screen in the last scan line of the interrupting mode line. For example, if such a DLI routine changes a color register, the old color will be displayed on the left half of the scan line and the new color will show up on the right half of the same scan line. Because of uncertain timing in the response of the 6502 to an interrupt, the border between the colors will not be sharp, but will jiggle back and forth irritatingly.

The solution to this problem is provided in the form of the WSYNC (wait for horizontal sync) register (hexadecimal address D40A). Whenever this register is addressed in any way, the ANTIC chip pulls down the RDY line on the 6502. This effectively halts the 6502 until the WSYNC register is reset by the next horizontal synch pulse. The result is that the 6502 freezes until the electron beam returns to the left edge of the screen. If you insert a STA WSYNC instruction just before an instruction that stores a value into a color register, the color being displayed will change



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Listing 1: A simple Atari BASIC program to demonstrate display-list interrupts. This program changes the screen color from blue to pink and darkens the character set halfway down the video display. The complete BASIC program in listing 1a contains the assembly-language routine given in listing 1b.

1a

```
10 DLIST=PEEK(560)+256*PEEK(561):REM    find display list
20 POKE DLIST+15,130:REM                insert interrupt instruction
30 FOR I=0 TO 19:REM                    loop for poking DLI service routine
40 READ A:POKE 1536+I,A:NEXT I
50 DATA 72,138,72,169,80,162,88
60 DATA 141,10,212,141,23,208
70 DATA 141,24,208,104,170,104,64
80 POKE 512,0:POKE 513,6:REM            poke in interrupt vector
90 POKE 54286,192:REM                   enable DLI
```

1b

```
PHA          save accumulator
TXA
PHA          save X-register
LDA #$50     dark color for characters
LDX #$58     pink
STA WSYNC    wait
STA COLPF1   store color
STX COLPF2   store color
PLA
TAX
PLA          restore registers
RTI          done
```

while the beam is off the left edge of the screen. The color transition will occur one scan line lower, but it will be neat and clean.

The proper way to use a display-list interrupt, then, is to set the DLI bit on the mode line *before* the mode line for which you want the action to occur. The DLI-service routine should first save the 6502 registers onto the stack and then load the 6502 registers with the new graphics values to be used. It should execute a STA WSYNC immediately before storing the new values into the appropriate ANTIC or CTIA registers. Finally, it should restore the 6502 registers and return from the interrupt. This procedure will guarantee that the graphics registers are changed while the electronic beam is off the screen and that the new display parameters take effect at the beginning of the desired line.

The program in listing 1 is a very simple DLI-service routine. It changes the background color from blue to pink. It also changes the color of the characters so that they show up as dark against the pink background. The upper half of the screen remains

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The program in listing 1 is a very simple DLI-service routine. It changes the background color from blue to pink. It also changes the color of the characters so that they show up as dark against the pink background. The upper half of the screen remains

blue even though the DLI routine keeps stuffing pink into the color register. This is because the operating system's vertical-blank-interrupt routine keeps stuffing blue into the color register during the vertical-blank period. The blue color comes from the operating system's shadow register for that color register. Every hardware color register is shadowed out to a RAM (random-access read/write memory) location. You may already know about these shadow registers at decimal locations 708 through 712. For most purposes, you can change colors by poking values into the shadow registers (see last month's article for an explanation of shadow registers). If you poke directly into the hardware registers, the operating system shadow process will wipe out your poked color within $\frac{1}{60}$ second (ie: at the top of a new screen display). For DLIs, however, you must store your new color values directly into the hardware registers. You cannot use a DLI to set the color of the first displayed line of the screen. The operating system takes care of that line for you (and the first line is off the top of the screen,

Listing 2: *Restoring the Atari attract mode to a display driven by display-list interrupts. Only two 6502 assembly-language instructions have to be added to the DLI routine. DRKMSK and COLRSH are page zero locations (hexadecimal 4E and 4F) set up and updated by the operating system during the vertical blank interrupt. When the attract mode is not in force, COLRSH takes a value of 00 and DRKMSK takes a value of hexadecimal FF. When attract mode is in force, COLRSH is given a new random value every four seconds and DRKMSK holds a value of hexadecimal F6. Thus, COLRSH scrambles the color and DRKMSK lops off the high-order luminance bit.*

```
LDA NEWCOL    LDA NEWCOL
STA WSYNC     EOR COLRSH
STA COLPF2    AND DRKMSK
              STA WSYNC
              STA COLPF2
```

anyway). Use DLIs to change colors of lines below the first line.

By stuffing colors directly into the hardware registers, you create a new problem: you defeat the automatic attract mode. Attract mode is a feature provided by the operating system. After nine minutes without a keypress, the colors on the screen begin to cycle through random hues at lowered luminances. This insures that a computer left unattended for several hours does not burn an image into the television screen.

It is easy to build attract mode into a DLI routine by inserting only two lines of assembly code, as shown in listing 2.

The implementation of attract mode in display-list interrupts exacerbates an already difficult problem: the shortage of execution time during a DLI. A description of DLI timing will make the problem more obvious.

DLI Timing

DLI execution is broken into three phases. Phase 1 covers the period from the beginning of the DLI to the STA WSYNC instruction. During phase 1, the electron beam is drawing the last scan line of the interrupting mode line. Phase 2 covers the period from the STA WSYNC instruction to the appearance of the beam on the television screen. Phase 2 corresponds to the horizontal blank; all graphics changes should be made during this phase. Phase 3 covers the period from the appearance of the beam on the screen to the end of the DLI-service routine. The timing of phase 3 is not critical.

One horizontal scan line takes 114 clock cycles of real time. A DLI reaches the 6502 on or around cycle number 15. The 6502 takes about 7 cycles to respond to the interrupt. The operating-system routine to service the interrupt and turn control over to the DLI-service routine takes 11 machine cycles. Thus, the DLI-service routine does not gain control until about 33 clock cycles have elapsed. Furthermore, the STA WSYNC instruction must begin by cycle number 103; this reduces the time available in phase 1 by 11 cycles. Finally, ANTIC's DMA (direct memory access) will steal some of the

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remaining clock cycles from the 6502. Nine cycles will be lost to memory-refresh DMA. This leaves an absolute maximum of 61 cycles available for phase 1. This maximum is achieved only with blank-line mode lines. Character and map mode instructions will result in the loss of one cycle for each byte of display data. The worst case arises with BASIC modes 0, 7, and 8, which require 40 bytes per line. Only 21 machine cycles are available to phase 1 in these modes. Thus, a phase 1 routine will have from 21 to 61 machine cycles of execution time available to it.

Phase 2, the critical phase, extends over 24 clock cycles of real time. As with phase 1, some of these cycles are lost to cycle-stealing DMA. Player-missile graphics will cost 5 cycles if they are used. The display instruction will cost 1 cycle. Two more cycles will be stolen if the Load Memory Scan option in the display list is used. Finally, 1 or 2 cycles may be lost to memory refresh or display-data retrieval. Thus, from 14 to 23

usable machine cycles are available to phase 2.

The problems of DLI timing now become obvious. To load, attract, and store a single color will consume 14 cycles. Saving the 6502 A, X, and Y registers onto the stack and then loading, attracting, and saving three colors into A, X, and Y registers will cost 47 cycles: most, if not all, of phase 1. Obviously, the programmer who wishes to use DLIs for extensive graphics changes will expend much effort on the timing of the DLI. *Fortunately, the beginning programmer need not concern himself with extensive timing calculations.* If only single-color changes or simple graphics operations are to be performed, cycle counting and speed optimization are unnecessary. These considerations are only important for high-performance situations.

No simple options are available to the programmer who needs to change more than three color registers in a single DLI. It might be possible to load, attract, and store a fourth color

early in phase 3, if that color is not displayed on the left edge of the screen. Similarly, a color not showing up on the right side of the screen could be changed during phase 1. Another approach is to break one overactive DLI into two less ambitious DLIs, each doing half the work of the original. The second DLI could be provided by inserting a single-scan-line blank instruction (with the DLI bit set) into the display list just below the main interrupting mode line. This will, of course, consume some screen space.

Another partial solution is to perform the attract chores during vertical-blank periods. To do this, two tables of colors must be kept in memory. The first table contains color values intended to be displayed by the DLI routines. The second table contains the attracted values of these colors. During vertical blank, a user-supplied interrupt-service routine fetches each color from the first table, attracts it, and stores the attracted color in the second table. The DLI

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Listing 3a: An assembly-language routine which is included in the multiple display-list-interrupt program shown in listing 3b.

PHA

TXA

PHA

INC COUNTR

LDX COUNTR

LDA COLTAB,X use page \$F0 for color table

STA WSYNC wait

STA COLBAK

CPX #\$4F last line?

BNE ENDDL1 no, exit

LDA #\$00 yes, reset counter

STA COUNTR

ENDDL1 PLA

TAX

PLA restore accumulator

RTI

routine then retrieves values directly from the second table without paying the time penalty for attract.

Multiple Display-List Interrupts

It is often desirable to have a number of DLIs occurring at several vertical positions on the screen. This is an important way to add color to a display. Unfortunately, there is only one DLI vector; if multiple DLIs are to be used, then the vectoring to the appropriate DLI must be implemented in the DLI routine itself. There are several ways to do this. If the DLI routine does the same process with different values, then it can be table-driven. On each pass through the DLI routine, a counter is incre-

mented and used as an index to a table of values. A sample DLI routine for doing this is given in listing 3.

Another way to implement multiple display-list interrupts is to use a DLI counter as a test for branching through the DLI-service routines to the proper DLI-service routine. This slows down the response of all the DLIs, particularly the ones at the end of the test sequence. A third method is to have each DLI-service routine write the address of the next routine into the DLI vector at hexadecimal locations 200 and 201. This should be done during phase 3. It is the most general solution to the problem of multiple DLIs and has the additional advantage that vectoring logic is per-

Listing 3b: A simple Atari BASIC program to demonstrate multiple display-list interrupts. This program puts 80 different colors on the video display. The complete BASIC program shown here contains the assembly-language routine given in listing 3a.

```

10 GRAPHICS 7

20 DLIST=PEEK(560)+256*PEEK(561):REM    find display list

30 FOR J=6 TO 84:REM                    give every mode line a DLI

40 POKE DLIST+J,141:REM                  BASIC mode 7 with DLI bit set

50 NEXT J

60 FOR J=0 TO 30

70 READ A:POKE 1536+J,A:NEXTJ:REM        poke in DLI service routine

80 DATA 72,138,72,238,32,6,175,32,6

90 DATA 189,0,240,141,10,212,141,26,208

100 DATA 224,79,208,5,169,0

110 DATA 141,32,6,104,170,104,64

120 POKE 512,0:POKE 513,6:REM            vector to DLI service routine

130 POKE 54286,192:REM                    enable DLI

```

formed after the time-critical portion of the DLI, not before.

Keyboard-Click Routine

The operating system keyboard-click routine interferes with the function of the DLI. Whenever a key is pressed and acknowledged, the on-board speaker is clicked. The timing for this click is provided by several STA WSYNC instructions. This can throw off the timing of a DLI routine and cause the screen colors to jump downward by one scan line for a fraction of a second. There is no easy solution to this problem. One possible remedy involves the VCOUNT register (hexadecimal location D40B), a read-only register in ANTIC that tells what scan line ANTIC is displaying. A DLI routine could examine this register to decide when to change a color. Another solution is to disable the operating system keyboard-service routine (a tedious job) and provide your own keyboard routine. A third alternative is to accept no in-

puts from the keyboard. If keypresses are not acknowledged, the screen jiggle does not occur.

Kernels

The display-list interrupt was designed to replace a more primitive software/hardware technique called a kernel. A kernel is a 6502 program loop that is precisely timed to the display cycle of a television set. By monitoring the VCOUNT register and consulting a table of screen changes catalogued as a function of VCOUNT values, the 6502 can arbitrarily control all graphics values for the entire screen. A high price is paid for this power: the 6502 is not available for computations during the screen-display period, which is about 75 percent of the time. Furthermore, no computation may consume more than the 4000 or so machine cycles available during vertical-blank and overscan periods. This restriction means that kernels can only be used with programs requiring little com-

putation, such as certain skill and action games. For example, the Basketball program for the Atari 400/800 uses a kernel; the program requires little computation but much color. The multicolored players in this game could not be done with display-list interrupts because DLIs are keyed to playfield vertical positions, not player positions.

It is possible to extend the kernel idea right into a single scan line and change graphics registers on the fly. In this way, a single color register can present several colors on a single scan line. The horizontal position of the color change is determined by the amount of time that elapses before the change goes in. Thus, by carefully counting machine cycles you can get more graphics onto the screen. Unfortunately, this is extremely difficult to achieve in practice. With ANTIC performing DMA on the 6502, it is very difficult to know exactly how many cycles have really elapsed; a simple count of 6502 cycles is not adequate.



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If ANTIC's DMA is turned off, the 6502 can assume full control of the display, but it must then perform all the work that ANTIC normally does. For these reasons, horizontal kernels are seldom worth the effort. If the two images to be displayed in different colors are widely separated, however, say by 20 color clocks or more, the separation should cover up the timing uncertainties and render this technique feasible.

Using Display-List Interrupts

The tremendous value of graphics indirection and all those modifiable registers in the hardware now becomes obvious. With display-list interrupts, every one of those registers can be changed dynamically. You can put lots of color, graphics, and special effects onto the screen. The most obvious application of DLIs is to put more color onto the screen. Each color register can be changed as many times as you have DLIs. This applies to both playfield color registers and player color registers. Thus, you have up to nine color registers, each of which can display up to 128 different colors. Of course, a normal program could not effectively use all of those colors. Too many DLIs start slowing down the whole program, and sometimes the screen layout cannot accommodate all of them. In practice, displaying a dozen colors is easy, two dozen requires careful planning, and more than that requires a contrived situation.

But DLIs can give more than color. They can also be used to extend the power of player-missile graphics by changing the horizontal position of a player. In this way, a player can be repositioned partway down the screen. A single player can then have several incarnations on the screen. If you imagine a player as a vertical column with images drawn on it, a DLI becomes a pair of scissors with which you can snip the column and reposition sections of it on the screen. Of course, no two sections of the player can be on the same horizontal line, and so two incarnations of the player cannot be on the same horizontal line. If your display needs allow graphics objects that will never be on

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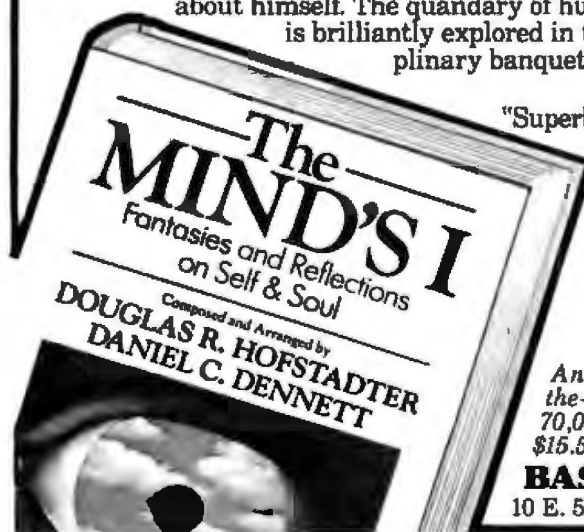
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the same horizontal line, a single player can do the job.

Another way DLIs can be used in conjunction with players is to change their width or priority. This would most often be used along with the priority-masking trick described in part 3 of this series last month.

DLIs can also be used to change character sets partway down the screen. This allows a program to use character graphics in a large window and regular text in a text window. Multiple character-set changes are possible. A program might use one graphics character set at the top of the screen, another graphics character set in the middle of the screen, and a

regular text character set at the bottom. A "Rosetta Stone" program would also be possible, showing different text fonts on the same screen. The vertical reflect bit can be changed with a DLI routine, allowing some text to be right side up and other text to be upside down.

The proper use of the DLI requires careful layout of the screen display. Designers must give close consideration to the vertical architecture of their displays. The raster-scan television system is not two-dimensionally symmetric; it has far more vertical structure than horizontal structure. This is because the pace for horizontal screen drawing is about

200 times faster than the pace for vertical screen drawing. The Atari 400/800 display system was designed specifically for raster-scan television, and it mirrors the anisotropy of the raster-scan system. The Atari 400/800 display is not a flat, blank sheet of paper on which you draw; it is a stack of thin strips, each of which can take different parameters. The programmer who insists on designing an isotropic display wastes many opportunities. You will achieve optimal results when you organize the information you wish to display in a strong vertical structure. This allows the display-list interrupt to be used to its greatest potential. ■

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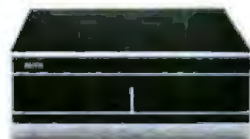
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Both Barrels, an arcade game for the Apple II. Floppy disk, \$24.95. Sirius Software (see address above).

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N Charles St, Baltimore MD 21201.

Cranston Manor, a graphics adventure for the Apple II. Floppy disk, \$34.95. On-Line Systems, 36575 Mudge Ranch Road, Coarsegold CA 93614.

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Atari

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Eastern Front (1941), a graphics war game for the Atari 800. Floppy disk, \$29.95. Atari Program Exchange, POB 427, 155 Moffet Park Dr, Sunnyvale CA 94086.

Fantasyland 2041 AD, a multipart, fantasy role-playing game for the Atari 800. Floppy disks, \$59.95. Crystalware, 12215 Murphy Ave, San Martin CA 95046.

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The Atari Tutorial

Part 5: Scrolling

Chris Crawford
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Quite frequently, the amount of information that a programmer wants to display exceeds the amount of information that can fit on the screen. One way of solving this problem is to scroll the information across the display. For example, listings of BASIC programs scroll vertically from the bottom of the screen to the top. All personal computers implement this type of scrolling. The Atari personal computer system, however, has two additional scrolling facilities that offer exciting possibilities. The first is Load Memory Scan (LMS) coarse scrolling; the second is fine scrolling.

Conventional computers use coarse scrolling. With this type of scrolling, the pixels that hold the characters are fixed in position on the screen and the text is scrolled by moving bytes through the screen random-access read/write memory (RAM). The resolution of the scrolling is a single character pixel, which is very coarse. (Throughout this article, the term pixel refers to an entire character, not to the smaller dots that make up a character.) This produces a jerky and quite unpleasant scrolling. Furthermore, it is achieved by moving up to a thousand bytes around in memory, a slow and clumsy task. In essence, the program must

move data through the playfield to scroll.

Some personal computers produce a somewhat finer scroll by drawing images in a higher-resolution graphics mode and then scrolling these images. Although higher scrolling resolution is achieved, more data must be moved to attain the scrolling and the program is consequently slowed.

The fundamental problem in both methods is that the scrolling is implemented by moving data through the screen area.

By manipulating just two address bytes, you can produce an effect identical to moving the entire screen RAM.

Coarse Scrolling

A better way to achieve coarse scrolling with the Atari 400/800 is to move the screen area over the data. The display-list op codes support a feature called Load Memory Scan (LMS). The LMS instruction was described in part 1 of this series. Briefly, it tells ANTIC where the screen memory is. A normal display list has one LMS instruction at the beginning of the display list. The RAM area it points to provides the screen data for the entire screen in a

linear sequence. By manipulating the operand bytes of the LMS instruction, a primitive scroll can be implemented. In effect, this moves the playfield window over the screen data. Thus, by manipulating just two address bytes, you can produce an effect identical to moving the entire screen RAM. The program in listing 1 does just that. This program sweeps the display over the entire address space of the computer. The contents of the memory are dumped onto the screen. The scroll is a clumsy serial scroll combining horizontal scrolling with vertical scrolling. A pure vertical scroll can be achieved by adding or subtracting a fixed amount (the line length in bytes) to the LMS operand. The program in listing 2 does that.

A pure horizontal scroll is not as simple to do as a pure vertical scroll because the screen RAM for a simple display list is organized serially. The screen-data bytes for the lines are strung in sequence, with the bytes for one line immediately following the bytes for the previous line. We can horizontally scroll the lines by shifting all the bytes to the left: this is done by decrementing the LMS operand. The leftmost byte on each line, however, will then be scrolled into the rightmost position in the next higher line. The sample program in listing 1 illustrated this.

The solution is to expand the screen-data area and break it into a series of independent, horizontal-line

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Listing 1: A simple program in Atari BASIC demonstrating coarse scrolling. Both horizontal and vertical scrolling are combined, but the end result is rather clumsy. The entire address space of the computer will be displayed.

```

10 DLIST = PEEK(560) + 256*PEEK(561):REM    find display list
20 LMSLOW = DLIST + 4:REM                  get low address of LMS operand
30 LMSHIGH = DLIST + 5:REM                 get high address of LMS operand
40 FOR I = 0 TO 255:REM                    outer loop
50 POKE LMSHIGH,I
60 FOR J = 0 TO 255:REM                    inner loop
70 POKE LMSLOW,J
80 FOR Y = 1 TO 50:NEXT Y:REM              delay loop
90 NEXT J
100 NEXT I

```

Listing 2: An Atari BASIC program demonstrating a pure vertical scroll. The line length (in bytes) is either added to or subtracted from the LMS operand to achieve upward and downward scrolling, respectively. Lines 70, 120, and 130 accomplish this for upward scrolling only.

```

10 GRAPHICS 0
20 DLIST = PEEK(560) + 256*PEEK(561)
30 LMSLOW = DLIST + 4
40 LMSHIGH = DLIST + 5
50 SCREENLOW = 0
60 SCREENHIGH = 0
70 SCREENLOW = SCREENLOW + 40:REM          next line
80 IF SCREENLOW < 256 THEN GOTO 120:REM    overflow?
90 SCREENLOW = SCREENLOW - 256:REM        yes, adjust pointer
100 SCREENHIGH = SCREENHIGH + 1
110 IF SCREENHIGH = 256 THEN END
120 POKE LMSLOW,SCREENLOW
130 POKE LMSHIGH,SCREENHIGH
140 GOTO 70

```

Listing 3: An Atari BASIC program demonstrating pure horizontal scrolling. Each display line is actually 256 characters (bytes) long, though only 20 can be observed at any time. The 256-byte line is used in this example to simplify the program by avoiding the use of 2-byte address manipulations. The display produced scrolls from right to left. Upon reaching the end of the line, it starts over from the beginning.

```

10 REM first set up the display list
20 POKE 1536,112:REM          8 blank lines
30 POKE 1537,112:REM          8 blank lines
40 POKE 1538,112:REM          8 blank lines
50 FOR I = 1 TO 12:REM        loop to put in display list
60 POKE 1536 + 3*I,71:REM      BASIC mode 2 with LMS set
70 POKE 1536 + 3*I + 1,0:REM   low byte of LMS operand
80 POKE 1536 + 3*I + 2,I:REM   high byte of LMS operand
90 NEXT I
110 POKE 1575,65:REM          ANTIC JVB instruction
110 POKE 1576,0:REM           display list starts at $0600
120 POKE 1577,6
130 REM tell ANTIC where display list is
140 POKE 560,0
150 POKE 561,6
160 REM now scroll horizontally
170 FOR I = 0 TO 235:REM       loop through LMS low bytes
175 REM we use 235—not 255—because screen width is 20 characters
180 FOR J = 1 TO 12:REM        for each mode line
190 POKE 1536 + 3*J + 1,I:REM   put in new LMS low byte
200 NEXT J
210 NEXT I
220 GOTO 170:REM               endless loop

```

data areas. Figure 1 illustrates this idea. On the left is the normal arrangement. One-dimensional serial RAM is stacked in linear sequence to create the screen-data area. On the right is the arrangement needed for proper horizontal scrolling. The RAM is still one-dimensional and serial, but it is now used differently. The RAM for each horizontal line extends much further than the screen can show. This is no accident. The whole point of scrolling is to let a program display more information than the screen can hold. We can't show all that extra information if we don't allocate the RAM to hold it. With this arrangement we can implement true horizontal scrolling. We can move the screen window over the screen data without the undesirable vertical roll of the earlier approach.

The first step in implementing pure horizontal scrolling is to determine the total horizontal line length and allocate RAM accordingly. Next, a completely new display list with an LMS instruction on each mode line is written. The display list will, of course, be longer than usual, but there is no reason why we cannot write such a list. What values are used for the LMS operands? It is most convenient to use the address of the first byte of each horizontal screen-data line, the points marked with Xs in figure 1. Each mode line on the screen will have one such address. Once the new display list is in place, ANTIC must be informed of it and screen data must be written to populate the screen. To execute a scroll, each and every LMS operand in the display list must be incremented for a rightward scroll or decremented for a leftward scroll. Program logic must insure that the image does not scroll beyond the limits of the allocated RAM areas; otherwise, garbage displays will result. In setting up such logic, the programmer must remember that the LMS operand points to the first screen-data byte in the displayed line. The maximum value of the LMS operand is equal to the address of the last byte in the long horizontal line minus the number of bytes in one displayed line. As this process is

rather intricate, let us work out an example.

First, the total horizontal line length is selected. For this example, we shall use a horizontal line length of 256 bytes. This will simplify address calculations. Each horizontal line will then require one page of RAM. Since we will use BASIC mode 2, 12 mode lines will be on screen; thus, 12 pages, or 3 K bytes, of RAM will be required. For simplicity (and to guarantee that our screen RAM will be populated with nonzero data) we will use the bottom 3 K bytes of RAM. Since this area is used by the operating system and disk operating system, it should be full of interesting data. To make matters more interesting, we'll put the display list on page 6 so that we can display it on the screen as we are scrolling. The initial values of the LMS operands will thus be particularly easy to calculate: the low-order bytes will all be zeros and the high-order bytes will be (in order) 0, 1, 2, etc.

The program in listing 3 performs these operations and scrolls the screen horizontally. This program scrolls the data from right to left. When the end of a page is reached, it simply starts over at the beginning. When executing this program, the display list is found on the sixth line down (it's on

page 6). It appears as a sequence of double quotation marks.

The next step is to mix vertical and horizontal scrolling to get diagonal scrolling. Horizontal scrolling is achieved by adding 1 to or subtracting 1 from the LMS operand. Vertical scrolling is achieved by adding the line length to or subtracting the line length from the LMS operand. Diagonal scrolling is achieved by executing both operations. Four diagonal-scroll directions are possible. If, for example, the line length is 256 bytes and we wish to scroll down and to the right, we must add $256 + (-1) = 255$ to each LMS operand in the display list. This is a 2-byte add; the BASIC program example given in listing 3 avoids the difficulties of 2-byte address manipulations. However, most programs will not be so contrived. For truly fast two-dimensional scrolling, assembly language is necessary.

All sorts of weird arrangements are possible if we differentially manipulate the LMS bytes. Lines could scroll relative to each other, or hop over each other. Some of this could be done with a conventional display, but more data would have to be moved to do it. The real advantage of LMS scrolling is its speed. Instead of manipulating an entire screen full of

data many thousands of bytes in size, a program need only manipulate perhaps a few dozen bytes.

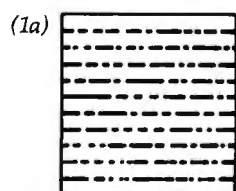
Fine Scrolling

The second important scrolling facility of the Atari 400/800 is the fine-scrolling capability, scrolling a pixel in steps smaller than the pixel size. Coarse scrolls proceed in steps equal to one pixel dimension; fine scrolls proceed in steps of one scan line vertically and one color clock horizontally. Fine scrolling can only be carried so far. To get full fine scrolling over the entire screen, we must use fine scrolling with coarse scrolling.

Only two steps are required to implement fine scrolling. First, we set the fine-scroll enable bits in the display-list instruction bytes for the mode lines in which we want fine scrolling. (Since we generally want the entire screen to scroll, we set all the scroll enable bits in all the display-list instruction bytes.) Bit D5 of the display-list instruction is the vertical-scroll enable bit; bit D4 of the display-list instruction is the horizontal-scroll enable bit. We then store the scrolling value desired into the appropriate scrolling register.

Two scrolling registers are available, one for horizontal scrolling and one for vertical scrolling. The horizontal-scroll register (HSCROL) is at hexadecimal address D404; the vertical-scroll register (VSCROL) is at hexadecimal address D405. For horizontal scrolling, we store in HSCROL the number of color clocks by which we want the mode line scrolled. For vertical scrolling, we store in VSCROL the number of scan lines that we want the mode line scrolled. These scroll values will be applied to

NORMAL DATA ARRANGEMENT



ARRANGEMENT FOR HORIZONTAL SCROLL

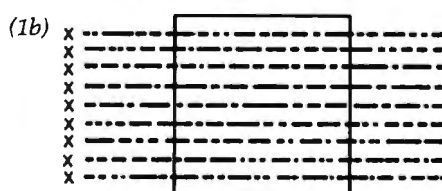


Figure 1: Figure 1a shows how screen data are normally organized. Horizontal scrolling can be accomplished by arranging the screen-data area as shown in figure 1b.

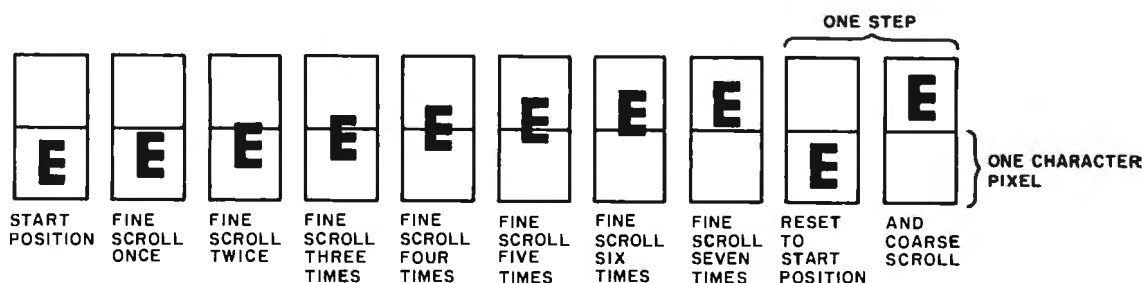


Figure 2: In order to achieve fine scrolling over the entire display screen, a combination of fine and coarse scrolling is used. After the seventh fine scroll is performed, the fine-scroll register is reset and a coarse scroll is performed.

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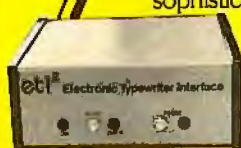
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Listing 4: An Atari BASIC program demonstrating fine scrolling. Scroll registers should be changed only during vertical blanking, necessitating assembly-language programming for most applications. Otherwise, ANTIC gets confused and causes the screen to jerk.

```

1  HSCROL = 54276
2  VSCROL = 54277
10  GRAPHICS 0:LIST
20  DLIST = PEEK(560) + 256 * PEEK(561)
30  POKE DLIST + 10,50:REM          enable both scrolls
40  POKE DLIST + 11,50:REM          do it for two mode lines
50  FOR Y=0 TO 7
60  POKE VSCROL,Y:REM              vertical scroll
70  GOSUB 200:REM                  delay
80  NEXT Y
90  FOR X=0 TO 3
100 POKE HSCROL,X:REM              horizontal scroll
110 GOSUB 200:REM                  delay
120 NEXT X
130 GOTO 40
200 FOR J=1 TO 200
210 NEXT J:RETURN

```

every line for which the respective fine scroll is enabled.

Two complicating factors are encountered when we use fine scrolling. Both arise from the fact that a partially scrolled display shows more information than a normal display. Consider, for example, what happens when we horizontally scroll a line by half a character to the left. The 40th character scrolls to the left, but what takes its place? Half of a new 41st character should scroll over to take the place of the now scrolled 40th character. But there are only 40 characters in a normal line.

The solution to this problem has already been built into the hardware with three display options for line widths: the narrow playfield (128 color clocks wide), the normal playfield (160 color clocks wide), and the wide playfield (192 color clocks wide). These options are chosen by setting appropriate bits in the DMACTL register. (DMACTL is at address D400 hexadecimal; most users will access shadow register SDMACTL at address 22F hexadecimal.) When using horizontal fine scrolling, ANTIC automatically retrieves more data from RAM than it displays. For example, if DMACTL is set for normal playfield, which in BASIC mode 0 has 40 bytes per line, ANTIC will actually retrieve data at a rate appropriate to wide playfield—48 bytes per line. This will throw lines off

horizontally if it is not taken into account. The problem does not appear if the programmer has already organized screen RAM into long horizontal lines as in figure 1.

The corresponding problem for vertical scrolling can be handled in two ways. The sloppy way is to ignore it. We will not get half images at both ends of the display. Instead, the images at the bottom of the display will not scroll properly; they will suddenly pop into view. The proper way takes very little work.

To get proper fine scrolling into and out of the display region, we must dedicate one mode line to act as a buffer. This is done by refraining from setting the vertical-scroll bit in the display-list instruction of the last mode line of the vertically scrolled zone. The window will now scroll without the unpleasant jerk and the screen image will be shortened by one mode line. An advantage of scrolling displays now becomes apparent. It is quite possible to create screen images that have more than 192 scan-lines in the display. This could be disastrous with a static display. However, with a scrolling display, images above or below the displayed region can always be scrolled into view.

Fine scrolling will only scroll so far. The vertical limit is 16 scan lines; the horizontal limit is 16 color clocks. If we attempt to scroll beyond these limits, ANTIC simply ignores the

higher bits of the scroll registers. To get full fine scrolling (in which the entire screen scrolls smoothly as far as we wish), we must couple fine scrolling with coarse scrolling. To do this we first fine scroll the image, keeping track of how far it has been scrolled. When the amount of fine scrolling equals the size of the pixel, we reset the fine-scroll register to zero and execute a coarse scroll. Figure 2 illustrates the process.

The program in listing 4 illustrates simple fine scrolling. It shows fine scrolling taking place at very slow speed and demonstrates several problems that arise when using fine scrolling. First, the display lines below the scrolled window are shifted to the right. This is due to ANTIC's automatically retrieving 48 bytes per line instead of 40. The problem arises only in unrealistic demonstration programs such as this one. In real scrolling applications, the arrangement of the screen data (as shown in figure 1) precludes this problem. A more serious problem arises when the scroll registers are modified while

ANTIC is in the middle of its display process. This confuses ANTIC and causes the screen to jerk. The solution is to change the scroll registers only during vertical-blank periods. This can be done only with assembly-language routines. Thus, fine scrolling normally requires the use of assembly language.

Applications

The applications of full fine scrolling for graphics are numerous. An obvious application is for large maps created with character graphics. Using BASIC graphics mode 2, I have created a large map of Russia that contains about 10 screens full of image. The screen becomes a window to the map. The user can scroll over the entire map with a joystick. The system is very memory efficient: the entire map program, data, display list, and character-set definitions require a total of about 4 K bytes of RAM.

Any very large image that can be drawn with character graphics is amenable to this system. (Scrolling

does not require character graphics, but map graphics are less desirable for scrolling applications because of their large memory requirements.) Large electronics schematics could be presented in this way. The joystick could be used both to scroll around the schematic and to indicate particular components that the user wishes to address. Large blueprints or architectural diagrams could also be displayed with this technique. Any big image that need not be seen in its entirety can be presented with this system.

Large blocks of text are also usable here, although it might not be practical to read continuous blocks of text by scrolling the image. This system is better suited to presenting blocks of independent text. One particularly exciting idea is to apply this system to menus. The program starts by presenting a welcome sign on the screen with signs pointing to submenus in other regions of the larger image. "This way to addition" might point up; "this way to subtraction" might point down. Users scroll around the menu with the joystick perusing their options. When making a choice, a cursor is placed on the option and the red button is pressed. Although this system could not be applied to all programs, it could be of great value to certain types of programs.

... And More

Two blue-sky applications of fine scrolling have not yet been fully explored. The first is selective fine scrolling, in which different mode lines of the display have different scroll bits enabled. Normally, we would want the entire screen to scroll, but it is not necessary to do so. We could select one line for horizontal scrolling only, another line for vertical scrolling only, and so forth. The second blue-sky feature is the prospect of using display-list interrupts to change the HSCROL or VSCROL registers "on the fly." Changing VSCROL on the fly is a tricky operation; it would probably confuse ANTIC and produce undesirable results. Changing HSCROL is also tricky, but might be easier. ■

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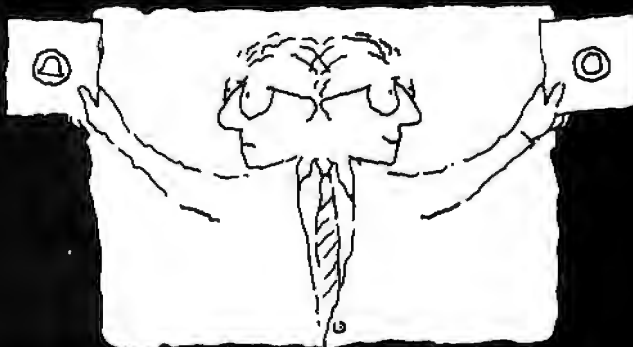
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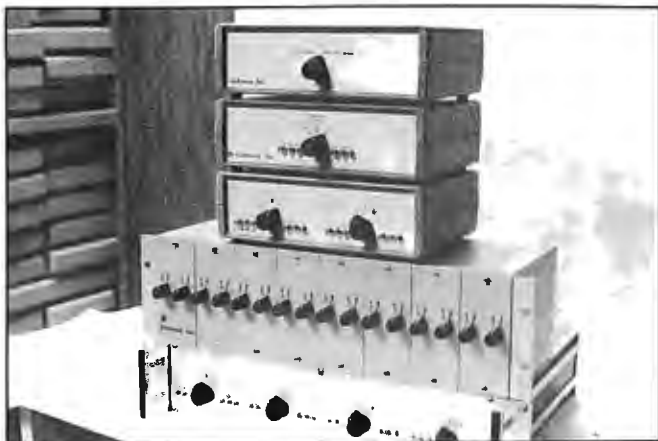
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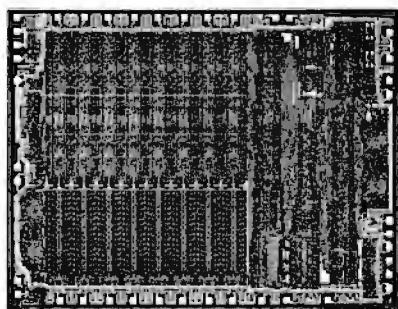
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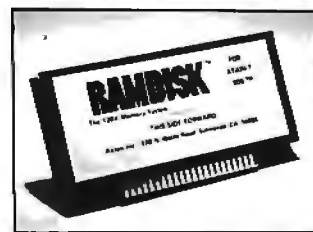
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The Atari Tutorial

Part 6: Atari BASIC

Lane Winner
Atari Inc.
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Atari BASIC is like other BASIC languages in that it is interpreted, which means that programs can be run when they are entered without intermediate stages of compilation and linking. The Atari BASIC interpreter resides in an 8K-byte ROM (read-only memory) cartridge in the left slot of the computer. It encompasses addresses A000 through BFFF hexadecimal. You must have at least 8K bytes of RAM (random-access read/write memory) to use Atari BASIC.

Strengths and Weaknesses

To use Atari BASIC effectively, you must know its strengths and weaknesses. With this information, programs can be written that make good use of its assets and features.

The strengths of Atari BASIC are:

- It supports the operating system graphics. Simple BASIC statements

can be used to display graphics information on the screen.

- It supports the hardware. BASIC statements such as SOUND, STICK, and PADDLE are simple interfaces to the hardware of the computer.

- It has a simple interface to assembly-language routines through the USR function.

- The BASIC interpreter is in ROM. This prevents accidental modification of the interpreter by the user program.

- It supports the Atari disk operating system (DOS). Specialized calls such as NOTE and POINT (in DOS 2.0S) allow the user to randomly access a disk through the disk operating system.

- It offers peripheral support. Any peripheral recognized by the operating system can be accessed from a BASIC program.

The weaknesses of Atari BASIC are:

- It gives no support of integers. All numbers are stored as 6-byte binary-coded-decimal (BCD) floating-point numbers.

- Mathematical operations are slow. Since all numbers are 6 bytes long, math operations become rather slow.
- It does not allow string arrays. Only one-dimensional strings can be created.

How Atari BASIC Works

The workings of the BASIC interpreter are summarized as follows:

1. BASIC gets a line of input from the user and converts it into a tokenized form.
2. It then puts this line into a token program.
3. This program is then available for execution.

The details of these operations are discussed in the following four sections:

- The Tokenizing Process
- The Token File Structure
- The Program Execution Process
- System Interaction

The Tokenizing Process

In simple terms, the tokenization of

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a line of code in BASIC looks like this:

1. BASIC gets a line of input.
2. It then checks for legal syntax.
3. During syntax checking, the line is tokenized.
4. The tokenized line is moved into the token program.
5. If the line is in immediate mode, it is executed.

To better understand the tokenizing process, some terms must first be defined:

Token—An 8-bit byte containing a value that corresponds to a BASIC keyword or element of syntax.

Statement—A complete "sentence" of tokens that causes BASIC to perform a meaningful task. When listed on the same line, statements are separated by colons.

Line—One or more statements preceded either by a line number in the range of 0 to 32,767, or an

immediate-mode line with no line number.

Command—The first executable token of a statement that tells BASIC to interpret the tokens that follow in a particular way.

Variable—A token that is an indirect pointer to its actual value; this is done so that the value can be changed without changing the token.

Constant—A 6-byte BCD value preceded by a special token. This value remains unchanged throughout program execution.

Operator—Any one of 46 tokens that in some way move or modify the values that follow them.

Function—A token that returns a value to the program when executed.

EOL—An end-of-line character that has the value 9B hexadecimal.

BCD—Binary-coded decimal. This refers to a number that uses the 6502 microprocessor's decimal mode.

BASIC begins the tokenizing process by getting a line of input. This input will be obtained from one of the handlers of the operating system. Normally, it is from the screen editor; however, with the ENTER command (which merges new program lines with an existing program), any device can be specified. The call BASIC issues is a GET RECORD command, and the data returned are ATASCII information terminated by an EOL. (ATASCII is a modified ASCII code used to represent characters and symbols within the Atari computers.) These data are stored by a part of the Atari operating system called the central I/O utility (CIO) into the BASIC input line buffer from locations 580 to 5FF hexadecimal.

After the record is returned, the syntax-checking and tokenizing processes begin. First, BASIC looks for a line number. If one is found, it is converted into a 2-byte integer. If no line number is present, the computer is assumed to be in immediate mode and the line number 8000 hexadecimal is assigned to it. These are the first two tokens of the tokenized line. This line is built in the token output buffer, which is 256 bytes long, and resides at the end of the reserved operating system RAM.

The next token is a dummy byte reserved for the byte count (or *offset*) from the start of this line to the start of the next line. Following this is another dummy byte for the count of the start of this line to the start of the next *statement*. These values are set when tokenization is complete for the line and the statement, respectively. The use of these values is discussed later in the program execution process section.

BASIC now looks for the command of the first statement of the input line. A check is made to determine if this is a valid command by scanning a list of legal commands in ROM. If a match is found, the next byte in the token line becomes the number of the entry in the ROM list that matched.

If at any time an error is found, a syntax error token is assigned to that byte and BASIC stops tokenizing,

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copies the rest of the input buffer in ATASCII format to the token output buffer, and prints the error line.

Assuming a good line, one of seven items can follow the command: a variable, a constant, an operator, a function, a double quote, another statement, or an EOL. BASIC tests to see if the next input character is numeric. If not, it compares that character and those following against the entries of the variable name table. If this is the first line of code entered in the program, no match will be found. The characters are then compared against the function and operator tables. If no match is found there, BASIC assumes that this is a new variable name. Since this is the first variable, it will be assigned the first entry in the variable name table. The characters are copied out of the input buffer and stored into the name table with the most significant bit (MSB) set to a logical 1 on the last byte of the name. Eight bytes are then reserved in the variable value table for this entry. (See the discussion of

the variable value table in the next section.)

The token that ends up in the tokenized line is the variable number minus one with the MSB set. Thus, the token of the first variable entered would be hexadecimal 80, the second would be hexadecimal 81, and so on up to hexadecimal FF, for a total of 128 unique variable numbers.

If a function is found, its entry number in the operator function table is assigned to the token. Functions require certain sequences of parameters; these are contained in syntax tables. If they are not matched, a syntax error will result.

If an operator is found, a token is given its table entry number. Since operators can follow each other in a rather complex fashion (such as multiple parentheses), the syntax checking of them is a bit complicated.

In the case of the double quotes, BASIC assumes that a character string is following, assigns a hexadecimal 0F to the output token, and reserves a dummy byte for the string

length. The characters are moved from the input buffer into the output buffer until the second set of quotes is found. The string-length byte is then set to the character count.

If the next characters in the input buffer are numeric, BASIC converts them into a 6-byte BCD constant. A hexadecimal 0E token is put in the output buffer, followed by the 6-byte constant.

When a colon is encountered, a hexadecimal 14 token is inserted in the output buffer, and the offset from the start of the line is stored in the dummy byte that was reserved for the count to the start of the next statement. At this point, another dummy byte is reserved and the process goes back to get a command.

When the EOL is found, a hexadecimal 16 token is stored and the offset from the start of the line is put in the dummy byte for the line offset. At this point, tokenization is complete and BASIC moves the token line into the token program. First, it searches the program for that line number. If

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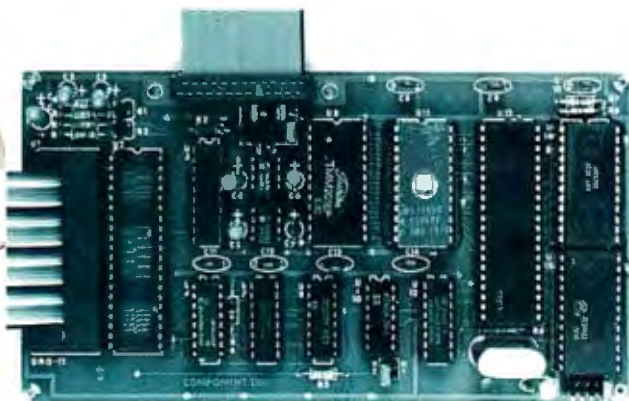
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the same number is found, the computer replaces the old line with the new one. If it is not found, the computer inserts the new line in the correct numerical sequence. In both cases, the data following the line are moved either up or down in memory to allow for an expanding and contracting program size.

BASIC now checks to see if the tokenized line is an immediate-mode line. If so, that line is executed according to the methods described in the interpretive process; if not, BASIC goes back to get another line of input.

If at any time during the tokenizing process the length of the token line exceeds 256 bytes, an Error 14 message (line too long) is sent to the screen and BASIC goes back to get the next line of input.

An example line of input and its token form are shown in figure 1. Table 1 shows the token values for Atari BASIC.

The Token File Structure

The token file contains two major segments: a group of zero-page pointers that point into the token file, and the actual token file itself. The zero-page pointers are 2-byte values that point to various sections of the token file. There are nine 2-byte pointers in locations 80 to 91 hexadecimal. The textbox on page 112 gives a list of the pointers and the sections of the token file they reference.

The Program Execution Process

Executing a line of code involves reading the tokens created during the

tokenization process. Each token has a particular meaning that causes BASIC to execute a specific series of operations. The method of doing this requires BASIC to get one token at a time from the token program and process it. Since the token is an index into a jump table of routines, a PRINT token points indirectly to a PRINT processing routine. When that processing is complete, BASIC returns to get the next token. The pointer used to fetch each token is called STMCUR and is at locations 8A and 8B hexadecimal.

The first line of code executed in a program is the immediate-mode line. This is usually a RUN or GOTO. In the case of the RUN, BASIC gets the first line of tokens from the statement table (tokenized program) and processes it. If all the code is in-line, BASIC merely executes consecutive lines.

If a GOTO is encountered, the line to go to must be found. The statement table contains a partially linked list of line numbers and statements. The lowest line number is first, followed by increasing line numbers up to the largest. If a line somewhere in the middle of the table is needed, the following process occurs.

The address of the first line is found in the STMTAB pointer at hexadecimal 88 and 89. This is stored in a temporary pointer. The first 2 bytes of the first line are its line number. This number is compared to the requested line number. If the first number is less, BASIC gets the next line by adding the third byte of the first line to the temporary pointer.

THE LINE:

10 LET X=1 : PRINT X

ITS TOKENIZED REPRESENTATION:

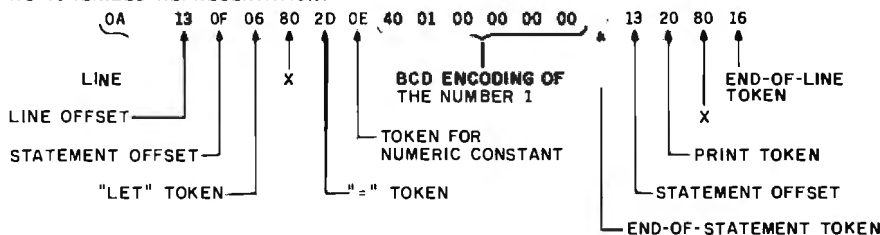


Figure 1: A line of Atari BASIC in tokenized form. The tokenized form of the line is the one stored in memory.

(a) Commands			(b) Operators			(c) Functions		
Hexa- decimal	Decimal	Meaning	Hexa- decimal	Decimal	Meaning	Hexa- decimal	Decimal	Meaning
00	0	REM	0E	14	[numeric constant]	3D	61	STR\$
01	1	DATA	0F	15	[string constant]	3E	62	CHR\$
02	2	INPUT	10	16	[not used]	3F	63	USR
03	3	COLOR	11	17	[not used]	40	64	ASC
04	4	LIST	12	18	,	41	65	VAL
05	5	ENTER	13	19	\$	42	66	LEN
06	6	LET	14	20	: [statement end]	43	67	ADR
07	7	IF	15	21	;	44	68	ATN
08	8	FOR	16	22	[line end]	45	69	COS
09	9	NEXT	17	23	GOTO	46	70	PEEK
0A	10	GOTO	18	24	GOSUB	47	71	SIN
0B	11	GO TO	19	25	TO	48	72	RND
0C	12	GOSUB	1A	26	STEP	49	73	FRE
0D	13	TRAP	1B	27	THEN	4A	74	EXP
0E	14	BYE	1C	28	#	4B	75	LOG
0F	15	CONT	1D	29	< =	4C	76	CLOG
10	16	COM	1E	30	< >	4D	77	SQR
11	17	CLOSE	1F	31	> =	4E	78	SGN
12	18	CLR	20	32	<	4F	79	ABS
13	19	DEG	21	33	>	50	80	INT
14	20	DIM	22	34	=	51	81	PADDLE
15	21	END	23	35	*	52	82	STICK
16	22	NEW	24	36	+	53	83	PTRIG
17	23	OPEN	25	37	+	54	84	STRIG
18	24	LOAD	26	38	-			
19	25	SAVE	27	39	/			
1A	26	STATUS	28	40	NOT			
1B	27	NOTE	29	41	OR			
1C	28	POINT	2A	42	AND			
1D	29	XIO	2B	43	(			
1E	30	ON	2C	44	)			
1F	31	POKE	2D	45	= [arithmetic assignment]			
20	32	PRINT	2E	46	= [string assignment]			
21	33	RAD	2F	47	< =			
22	34	READ	30	48	< >			
23	35	RESTORE	31	49	> =			
24	36	RETURN	32	50	<			
25	37	RUN	33	51	>			
26	38	STOP	34	52	=			
27	39	POP	35	53	+			
28	40	?	36	54	-			
29	41	GET	37	55	([string left parenthesis]			
2A	42	PUT	38	56	([array left parenthesis]			
2B	43	GRAPHICS	39	57	([DIM array left parenthesis]			
2C	44	PLOT	3A	58	([function left parenthesis]			
2D	45	POSITION	3B	59	([DIM string left parenthesis]			
2E	46	DOS	3C	60	, [array comma]			
2F	47	DRAWTO						
30	48	SETCOLOR						
31	49	LOCATE						
32	50	SOUND						
33	51	LPRINT						
34	52	CSAVE						
35	53	CLOAD						
36	54	[IMPLIED LET]						
37	55	ERROR— [SYNTAX]						

Table 1: A table of token values for Atari BASIC. Table 1a shows the interpretation of a given value as a BASIC command token. Table 1b shows the interpretation of a value as a BASIC operator token. Table 1c shows the interpretation of a value as a BASIC function token. The interpretation of a token value varies with its position in the line.

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The temporary pointer will be pointing to the second line. Again, the first 2 bytes of this new line are compared to the requested line. If they are less, the third byte is added to the pointer. If a line number does match, the contents of the temporary pointer are moved into STMCUR and BASIC fetches the next token from the new line. Should the requested line number not be found, an Error 12 (line not found) is generated.

The GOSUB involves more processing than the GOTO. The line-finding routine is the same, but before BASIC goes to that line, it sets up an entry in the run-time stack. It allocates 4 bytes at the end of the stack and stores a 0 in the first byte to indicate a GOSUB stack entry. It then stores the line number it was on when the call was made into the next 2 bytes of the stack. The final byte contains the offset in bytes from the start of that line to where the GOSUB token was found. BASIC then executes the line it looked up. When the RETURN is found, the entry on the stack is pulled off, and BASIC returns to the calling line.

The FOR command causes BASIC to allocate 16 bytes on the run-time stack. The first 6 bytes are the limit the variable can reach in 6-byte BCD format. The second 6 bytes are the step, in the same format. Following these, BASIC stores the variable number (MSB set) of the counting variable. It then stores the present line number (2 bytes) and the offset into the line. The rest of the line is then executed.

When BASIC finds the NEXT command, it looks at the last entry on the stack. It makes sure that the variable referenced by the NEXT is the same as the one on the stack and checks if the counter has reached or exceeded the limit. If not, BASIC returns to the line with the FOR statement and continues execution. If the limit was reached, the FOR entry is pulled off the stack and execution continues from that point.

When an expression is evaluated, the operators are put onto an operator stack and then pulled off one at a time and evaluated. The

BASIC Command	Operating System IOCB Parameters
OPEN #1,12,0,"E:"	IOCB = 1 Command = 3 (OPEN) Aux1 = 12 (Input/Output) Aux2 = 0 Buffer Address = ADR("E:")
GET #1,X	IOCB = 1 Command = 7 (Get Characters) Buffer Length = 0 Character returned in accumulator
PUT #1,X	IOCB = 1 Command = 11 (Put Characters) Buffer Length = 0 Character output through accumulator
INPUT #1,A\$	IOCB = 1 Command = 5 (Get Record) Buffer Length = Length of A\$ (not over 256) Buffer Address = Input Line Buffer
PRINT #1, A\$	IOCB = 1 BASIC uses a special put byte vector in the IOCB to talk directly to the handler.
XIO 18,#6,12,0,"S:"	IOCB = 6 Command = 18 (Special—Fill) Aux1 = 12 Aux2 = 0

Table 2: Examples of BASIC I/O commands and the corresponding parameters that are passed to the operating system IOCBs (input/output control blocks).

order in which the operators are put onto the stack can either be implied, in which case BASIC looks up the operator's precedence from a ROM table, or the order can be explicitly stated by the placement of parentheses.

Pressing the BREAK key at any time causes the operating system to set a flag to indicate this occurrence. BASIC checks this flag after each token is processed. If it finds it has been set, it stores the line number at which this occurred, prints a "STOPPED AT LINE XXXX" message, clears the BREAK flag, and waits for user input. At this point, the user could type CONT and program execution would continue at the next line.

System Interaction

BASIC communicates with the operating system primarily through the use of I/O calls to the central I/O utility. Table 2 gives a list of user BASIC calls and the corresponding operating system IOCBs. (IOCB stands for "input/output control block." An IOCB is a table of information used to control information flow between the computer and either a disk file or I/O device.)

When a BASIC token program is SAVED or CSAVED to a device, two blocks of information are written. The first block consists of seven of the nine zero-page pointers that BASIC uses to maintain the token file. These are LOMEM through STARP (see textbox). One change is made to these pointers when they are written out: the value of LOMEM is subtracted from each of the 2-byte pointers, and these new values are written to the device. Thus, the first 2 bytes written are 0,0.

The second block of information written consists of the following token file sections: the variable name table, the variable value table, the token program, and the immediate-mode line.

When this program is LOAded or CLOAded into memory, BASIC looks at the operating system variable MEMLO and adds its value to each of the 2-byte zero-page pointers as they are read from the device. These

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pointers are placed back on page zero. The values of RUNSTK and MEMTOP are then set to the value in STARP. (See figure 2 for the locations of these and other pointers.)

Next, 256 bytes are reserved in memory above the value of MEMLO to allocate space for the token output buffer. Then, the token file information, consisting of the variable name table through the immediate-mode line, is read in. These data are placed in memory immediately following the token output buffer.

Improving Program Performance

Program performance can be improved in two ways. First, the execution time can be decreased (it will run faster); second, the amount of space required can be decreased, allowing it to use less RAM. To attain these two goals, the following lists can be used as guidelines. The methods of improvement in each list are primarily arranged in order of decreasing effectiveness. Therefore, the method at the top of a list will have more impact than one at the bottom.

The following methods will help speed up a BASIC program:

- **Recode**—Because BASIC is not a structured language, the code written in it tends to be inefficient. After many revisions, it becomes even worse. Thus, the time spent to restructure the code is worthwhile.
- **Check algorithm logic**—Make sure that the code to execute a process is as efficient as possible.
- **Put frequently called subroutines and FOR/NEXT loops at the start of the program**—Since BASIC starts at the beginning of a program to look for a line number, any line references near the end take longer to reach.
- **For frequently called operations within a loop, use in-line code rather than subroutines**—The program speed can be improved here since BASIC spends time adding and removing entries from the run-time stack.
- **Make the most frequently changing loop of a nested set the deepest**—In this way, the run-time stack will be altered the fewest number of times.
- **Simplify floating-point calculations within the loop**—If a result is obtained by multiplying a constant by a counter, time can be saved by changing the operation to the addition of a constant.
- **Set up loops as multiple statements on one line**—In this way, the BASIC interpreter will not have to get the next line to continue the loop.
- **Disable the screen display**—If visual information is not important for a period of time, up to a 30-percent time savings can be made with a POKE 559,0. Save the previous value in location 559 so you can later restore the video output.
- **Use a coarser graphics mode or a short display list**—If a full screen display is not necessary, up to a 25-percent time savings can be made by causing the computer to spend less time on video display.
- **Use assembly code**—Time savings can be made by encoding loops in assembly language and using the USR function.

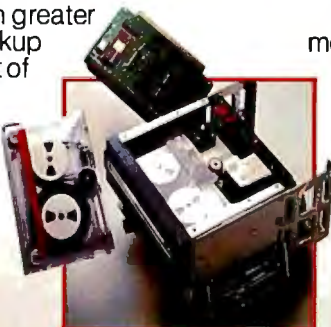
The following methods will help save space in a BASIC program:

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• Recode—As mentioned previously, restructuring the program makes it more efficient. It also saves space.

• Remove remarks—Remarks are stored as ATASCII data and merely take up space in the running program.

• Replace a constant used three times or more with a variable—BASIC allocates 7 bytes for a constant, but only 1 for a variable reference. Therefore, 6 bytes can be saved each time a constant is replaced with a variable assigned to that constant's value.

• Initialize variables with a READ statement—A data statement is stored in ATASCII code, 1 byte per character, whereas an assignment statement requires 7 bytes for one constant.

• Try to convert numbers used only

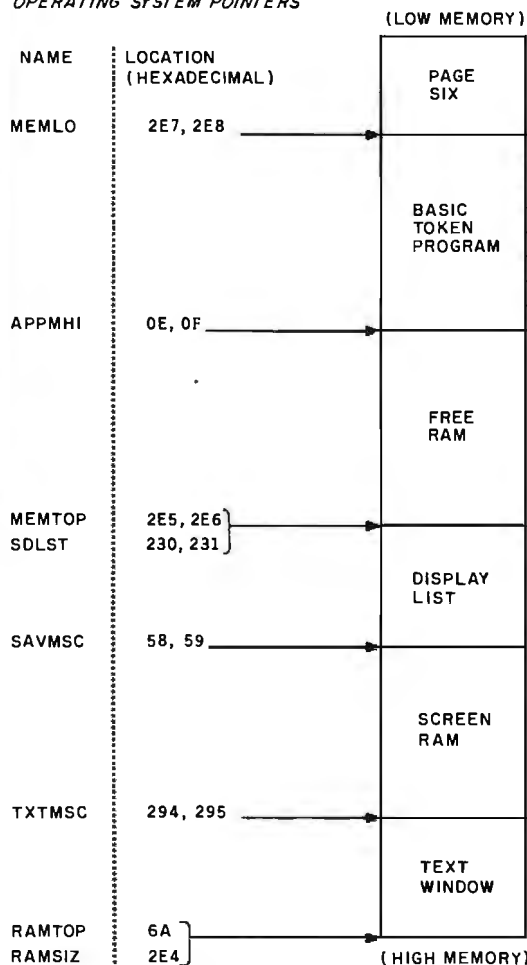
once and twice to arithmetic combinations of predefined variables—An example is to define Z1 to equal 1 and Z2 to equal 2; if the number 3 is required, replace it with the expression Z1 + Z2.

• Set frequently used line numbers (in GOSUB and GOTO) to predefined variables—If the line 100 is used in 50 different places, approximately 300 bytes can be saved by equating Z100 to 100 and referencing Z100.

• Keep the number of variables to a minimum—Each new variable entry requires 8 more bytes in the variable value table and a few bytes for its name.

• Clean up the value and name tables—Because the variable value and name tables are normally saved with the BASIC program, variable entries continue to take up space even

OPERATING SYSTEM POINTERS



BASIC POINTERS

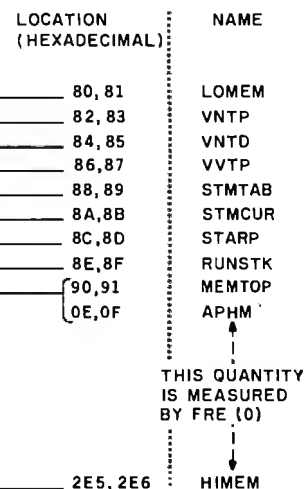


Figure 2: A list of pointers used by BASIC and the Atari operating system to keep track of memory usage. These pointers are described in greater detail in the operating system section of the Atari Personal Computer System Operating System User's Manual and Hardware Manual.



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after all references to them are removed from the program. To delete the entries, LIST the program to disk or cassette, type NEW, and ENTER the program. (Unlike SAVE or CSAVE, LIST stores the program as a file of characters and ENTER reads the program in as if it had been typed in from the keyboard.)

- Keep variable names as short as possible—Each variable name is stored in the name table as ATASCII information. The shorter the names, the shorter the table.

- Replace text used repeatedly with strings—On screens with a lot of text, space can be saved by assigning a string to a commonly used set of characters.

- Initialize strings with assignment statements—An assignment of a string with data in quotes requires less space than a READ statement and a CHR\$ function.

- Concatenate lines into multiple statements—Three bytes can be saved each time two lines are converted into two statements on one line.

- Replace once-used subroutines with in-line code—The GOSUB and RETURN statements waste bytes if used only once.

- Replace integer numeric arrays with strings if the data values fall between 0 and 255 (or if the data can be scaled to that range)—Numeric array entries require 6 bytes each. However, each number can be reduced to one character by using the CHR\$ function; it can later be restored with the ASC function.

- Replace SETCOLOR statements with POKE commands—This saves 8 bytes per occurrence.

- Use cursor-control characters rather than POSITION statements—The POSITION statement requires 15 bytes for the x and y parameters, whereas the cursor-editing characters are 1 byte each.

- Delete lines of code via program control—See the next section on advanced programming techniques.

- Modify the string/array pointer to load predefined data—SAVE and CSAVE save the part of the token file from VNTP up to STARP. By changing the value in STARP to point to

the end of the data, string and array information can be saved.

- Small assembly-language routines can be stored in USR calls—An example would be:

```
X=USR(ADR("hhh[ ]LV[ ]"),16)
```

(The boxes represent inverse video characters.) Eight bytes are saved by not placing the string in a named string variable.

- Chain programs—An example would be an initialization routine that is run first, then loads and runs the main program.

Advanced Applications

An understanding of the fundamentals of Atari BASIC makes it possible to write some interesting applications. These can be strictly BASIC operations, or they can also involve features of the operating system. The following paragraphs give examples of three such techniques.

String initialization—The program in listing 1 sets all the bytes of a string of any length to the same value. BASIC copies the first byte of the

Text continued on page 118

Listing 1: Quick string manipulation using the Atari BASIC substring function. This program will initialize every character of the string A\$ to the value "A".

```
10 REM STRING INITIALIZATION
20 DIM A$(1000)
30 A$(1)="A":A$(1000)="A"
40 A$(2)=A$
```

Listing 2: Modification of an Atari BASIC program under program control. By using a special "forced read" mode, information on the screen can be automatically read into BASIC without user intervention. In this program, this ability is used to delete lines 70 through 90 while the program is being run.

```
10 REM DELETE LINE EXAMPLE
20 GRAPHICS 0:POSITION 2,4
30 ? 70:? 80:? 90:? "CONT"
40 POSITION 2,0
50 POKE 842,13:STOP
60 POKE 842,12
70 REM THESE LINES
80 REM WILL BE
90 REM DELETED
```


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Atari BASIC Zero-Page Pointers

Name	Pointer		Part of Token File Pointed To
	Location (hex)		
LOMEM	80,81		Token output buffer—The buffer BASIC uses to tokenize one line of code. It is 256 bytes long and resides at the end of the operating system's allocated RAM.
VNTP	82,83		Variable name table—A list of all the variable names that have been entered in the program. They are stored as ATASCII characters, each new name stored in the order it was entered. Three types of name entries exist: 1. Scalar variables—MSB (most significant bit) set on last character in name. 2. String variables—last character is a "\$" with the MSB set. 3. Array variables—last character is a "(" with the MSB set.
VNTD	84,85		Dummy end of the variable name table—BASIC uses this pointer to indicate the end of the name table. When there are less than 128 variables, this normally points to a dummy zero byte. When 128 variables are present, this points to the last byte of the last variable name.
VVTP	86,87		Variable value table—This table contains current information on each variable. For each variable in the name table, 8 bytes are reserved in the value table. The information for each variable type is:

Byte Number	1	2	3	4	5	6	7	8
Scalar	00	Var#	6-byte BCD constant					
Array (explicitly dimensioned)	41	Var#	Offset from STARP(8C,8D)		first DIM + 1		second DIM + 1	
String (explicitly dimensioned)	81	Var#	Offset from STARP(8C,8D)		Length		DIM	

A scalar variable contains a numeric value. An example is $X=1$. The scalar is X and its value is 1, stored in 6-byte BCD format. An array is composed of numeric elements stored in the string/array area and has one entry in the value table. A string, composed of character elements in the string/array area, also has one entry in the table.

The first byte of each value entry indicates the type of variable: 00 for a scalar, 40 for an array, and 80 for a string. If the array or string has been dimensioned, the least significant bit (LSB) is set on the first byte.

The second byte contains the variable number. The first variable entry is number zero. If 128 variables were present, the last would be hexadecimal 7F.

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In the case of the scalar variable, the third through eighth bytes contain the 6-byte BCD number that has currently been assigned to it.

For arrays and strings, the third and fourth bytes contain an offset from the start of the string/array area (described below) to the beginning of the data.

The fifth and sixth bytes of an array contain its first dimension. The quantity is a 16-bit integer, and its value is 1 greater than the limit the user entered. The seventh and eighth bytes are the second dimension, also a value of 1 greater.

The fifth and sixth bytes of a string are a 16-bit integer that contains its current length. The seventh and eighth bytes are its dimension (up to 32,767 bytes in size).

STMTAB 88,89 Statement table—This block of data includes all the lines of code entered by the user and tokenized by BASIC. It also includes the immediate-mode line. The format of these lines is described in figure 1.

STMCUR 8A,8B Current statement—This pointer is used by BASIC to reference particular tokens within a line of the statement table. When BASIC is waiting for input, this pointer is set to the beginning of the immediate-mode line.

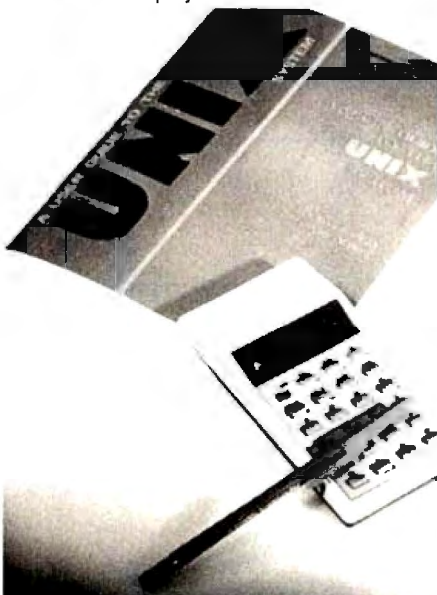
STARP 8C,8D String/Array area—This block contains all the string and array data. String characters are stored as 1-byte ATASCII entries. Therefore, a string of 20 characters will require 20 bytes. Arrays are stored with 6-byte BCD numbers for each element. A 10-element array requires 60 bytes.

This area is allocated and subsequently enlarged by each dimension statement encountered, the amount being equal to the size of a string dimension or six times the size of an array dimension.

RUNSTK 8E,8F Run-time stack—This software stack contains GOSUB and FOR/NEXT entries. The GOSUB entry consists of 4 bytes. The first is a 0 byte indicating GOSUB, followed by the 2-byte integer line number on which the call occurred. This is followed by the offset into that line so that the RETURN can come back and execute the next statement.

The FOR/NEXT entry contains 16 bytes. The first is the limit the counter variable can reach. The second byte is the step or counter increment. Each of these quantities is in 6-byte BCD format. The thirteenth byte is the counter variable number with the MSB set. The fourteenth and fifteenth bytes are the line number; the sixteenth is the line offset to the FOR statement.

MEMTOP 90,91 Top of application RAM—This is the end of the user program. Program expansion can occur from this point to the end of free RAM, which is defined by the start of the display list. The FRE function in BASIC returns the amount of free RAM by subtracting MEMTOP from HIMEM (pointed to by locations hexadecimal 2E5 and 2E6). Note that the BASIC MEMTOP is not the same as the OS variable called MEMTOP.



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Listing 3: Quick manipulation of a graphics player within Atari BASIC. By setting a string variable to point to the 512-byte area reserved for a player and manipulating that string, a player can be moved around the screen faster than is otherwise possible in BASIC. This program creates a small rectangle that glides across the video screen, changing direction when it nears the boundary of the video display.

```
100 REM PLAYER/MISSILE EXAMPLE
110 DIM A$(512),B$(20)
120 X=X+1:READ A:IF A<>-1 THEN B$(X,X)=CHR$(A):GOTO 120
130 DATA 0,255,129,129,129,129,129,129,129,129,255,0,-1
140 REM B$ CONTAINS PATTERN FOR PLAYER SHAPED LIKE SMALL BOX
2000 POKE 559,62:POKE 704,88
2020 I=PEEK(106)-16:POKE 54279,I
2030 POKE 53277,3:POKE 710,224
2040 VTAB=PEEK(134)+PEEK(135)*256:REM VALUE OF VVTP POINTER
2050 ATAB=PEEK(140)+PEEK(141)*256:REM VALUE OF STARP POINTER
2060 OFFS=I*256+1024-ATAB
2070 HI=INT(OFFS/256):LO=OFFS-HI*256
2090 POKE VTAB+2,LO:POKE VTAB+3,HI:REM A$ POINTS TO P/M AREA
3000 Y=60:Z=100:V=1:H=1
4000 A$(Y,Y+1)=B$:POKE 53248,Z:REM VERT AND HORIZ POSITION CHANGED
4010 Y=Y+V:Z=Z+H
4020 IF Y>213 OR Y<33 THEN V=-V
4030 IF Z>206 OR Z<49 THEN H=-H
4420 GOTO 4000
```

Text continued from page 110:

source string into the first byte of the destination string, then the second, third, and so on. By making the destination string the second byte of the source (A\$(2) refers to the substring of A\$ from its second through its last character), the same character can be stored throughout the entire string.

Delete lines of code—By using a feature of the operating system, a program such as listing 2 can delete or modify lines of code within itself. The screen editor can be set to accept data from the screen without user input. The POKE in line 50 causes the Atari screen editor device to do a "forced read" of the information on the screen, while the POKE in line 60 restores control of the computer to the keyboard. (For more information, see the section on the screen editor within the "I/O Subsystem" chapter of the *Atari Personal Computer System Operating System User's Manual and Hardware Manual*.) Thus, by first setting up the screen, positioning the cursor to the top, and then stopping the program, BASIC gets the commands that have been printed on the screen.

Player/missile graphics with strings—A fast way to move player/missile graphics data is shown in listing 3. This program places a small box on the screen (a player) and

causes it to bounce around the screen. A dimensioned string A\$ has its string/array area offset value changed to point to the player/missile graphics area. Writing to this string with an assignment statement now writes data into the player/missile area at assembly-language rates.

In particular, the first statement in line 4000 moves the player image in string B\$ up or down the vertical "strip" that the player occupies. The second statement changes the horizontal position of the "strip." When the box reaches the vertical limits of 33 or 213 (line 4020) or the horizontal limits of 49 or 206 (line 4030), the direction of the box movement is reversed.

Next Month

We will next take a look at the sound-generating capabilities of the Atari 400 and 800 computers. ■

More detailed information on several of the subjects discussed here is contained in the *Atari Personal Computer System Operating System User's Manual and Hardware Manual*. This manual (part C016555) can be ordered for \$27 plus \$3 shipping and handling from Atari Customer Service, 1346 Bordeaux Dr., Sunnyvale, CA 94086. California residents must add 6½% sales tax.

Book Reviews

Beyond Games: Systems Software for Your 6502 Personal Computer

Ken Skier
BYTE/McGraw-Hill
New York, 1981
433 pages, softcover \$14.95

Reviewed by
Bob Katz
248 East 90th St. Apt. 3B
New York, NY 10028

At last! An assembly-language programming book that develops useful, real-world tools, has no mathematical routines, and is written in plain English. In fact, *Beyond Games* not only teaches you how to write programs, it's entertaining.

If you own an Apple II, Ohio Scientific

Challenger I-P, PET 2001, or Atari 800, you'll be able to make *direct* use of the routines developed in this book. But owners of other 6502-based machines (such as KIM, SYM, AIM, etc.) need not despair—Ken Skier's routines interface directly with a microprocessor's *software*, not with any system-specific hardware.

For example, Skier develops a *text-editing program* step by step. One of the first things this program must do is find the ASCII value of a key that has been pressed. Skier teaches us that calling a subroutine is a sound programming technique to perform the maneuver. He gives this subroutine the name GETKEY. All microcomputers that have keyboards already contain the housekeeping routines used to get the value of a key. Some computers call it GETKEY, others may call it by a different name, e.g., GETCHR for "get character." But essentially this subroutine always reduces to a single ROM (read-only memory) address which may be called from Skier's main program.

Skier has researched this calling ad-

dress, as well as the addresses of all other necessary subroutines within the Apple II and the other computers. *Beyond Games* contains specific Apple, Atari, PET, and OSI versions of a machine-language text-editor program, visible-monitor program, print utilities, and screen-management utilities. These programs are identical in their assembly-language source-code form, regardless of the computer. Thus, owners of other 6502-based computers who wish to use Skier's programs can look up the addresses of their GETKEY or other routines, then substitute these addresses. The documentation provided with a computer should give the addresses of important ROM subroutines.

You may wish to develop an assembly-language or machine-language program on your own, or alter some of the routines for a specific computer not directly supported by the book. You should have no trouble doing this. Skier teaches how to structure a program using the "top down" technique and how to deal with problems in little pieces—in other words, how to proceed logically through the writing of an assembly-language program.

A word about the specific routines. Skier's text editor is very basic and is *not* designed to be a word processor. It is designed to write and edit text for inserting (and deleting) strings of any size into any memory location. Even if you don't need any of the routines he provides, the exercise of reading *Beyond Games* will teach you just how a text-editing program is constructed. That alone is worth the price of the book.

If you do decide to use his routines, Skier provides several means to load them into your computer. The easiest (and most expensive) method is to order a data cassette directly from Skier. The next easiest is to key in the machine-language programs from BASIC by using data statements and Skier's *object-code loader*. The latter program contains checksums to protect you from entering mistakes into memory. With care you can also load routines directly into memory as hexadecimal bytes.

In conclusion, those programmers who wish to learn how to write such mathematical routines as 16-bit arithmetic and logarithms should look elsewhere; those who wish to learn how to turn on the relay that controls their lawn sprinkler should also look elsewhere. But anyone who wants to learn to create logical machine-language programs, debuggable programs, or well-documented programs, should read *Beyond Games*. ■

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chines use similar circuitry, they may use different addresses for I/O manipulations. This doesn't make it impossible to interface, just time consuming and aggravating.

Any of the kits on the market are excellent buys. The kit that is best for you depends on your budget and requirements.

In any event, have fun and good luck. . . . Steve

Selectric as Printer

Dear Steve,

I have an Atari 800 and would like to add a printer of some sort, but the cost of a quality unit is beyond my budget. My mom has an IBM Selectric typewriter, and I have seen ads for a device that enables a computer to use a Selectric as a printer. What do you know about this? How much will it cost? Do I need an expansion interface? Which typewriter functions can the computer control? How much memory does the software require. At what speeds will it be capable of typing?

Mike Sutherland
Appleton, WI

The IBM Selectric typewriter can be used as a printer for a computer only if the character selection solenoids are installed. Office Selectrics, which I assume is what your mother has, do not have these solenoids and thus cannot be driven by a computer. It is not practical to install these solenoids yourself.

The Selectric I/O (input-output) typewriter, currently available on the used-equipment market, has the necessary solenoids to be computer driven. In addition, these typewriters are of a heavier construction and quite durable. Consult the ads in BYTE for price and condition.

Escon Products, Inc., 12919 Alcosta Blvd., San Ramon, CA 94583, sells a unit to adapt an office-type Selectric to a computer, but it costs around \$600, the price of a dot-matrix printer.

A line of universal electric typewriter interfaces is made by Rochester Data Inc., 3000 South Winton Rd., Bldg. A, Rochester, NY 14623, (716) 224-7804. Different models cost \$600 to \$800.

You will need some kind of interface to take the TTL (transistor-transistor logic) signals from the computer and enable them to drive 30- or 48-volt solenoids.

The computer can enable all of the typewriter functions, if the solenoids are available for each function.

A computer program to drive the Selectric will take approximately 300 bytes including a look-up table for the type-ball codes.

Selectrics are rated for 13.4 cps (characters per second) maximum, but actual speed will depend on the driver program used.

For more information see "Interfacing the IBM Selectric Keyboard Printer" by Dan Fylstra in the June 1977 BYTE, page 46. It is an excellent article on interfacing the Selectric. . . . Steve

In "Ask BYTE," Steve Garcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

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Missile Command

Stanley J. Wszola
Technical Editor

As your left thumb stabs at the firing button, your right hand spasmodically tries to control the cursor. You see flashes of light, hear bursts of sound, and finally it's over. You've done it, racked up your best score ever playing Missile Command. Have you ever wondered why Missile Command is such a popular game? Despite the claims of Atari that its

development was a long process, there are other reasons for its success. In this review, I'd like to touch lightly upon some of these reasons.

If you have never pumped a quarter into a video arcade game, or don't own an Atari 400 or 800 microcomputer, I'll briefly describe the game. The Missile Command game for the Atari 400 and 800 is an

adaptation of the commercial arcade game. You become the commander of a missile base with armaments consisting of ABMs (antiballistic missiles). You must preserve your six cities and missile base from nuclear attack by destroying the incoming enemy missiles and bombs.

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At a Glance

Name

Missile Command

Type

Arcade-type game

Manufacturer

Atari Inc.
1265 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2213

Price

\$39.95

Format

Plug-in ROM cartridge

Language

6502 machine language

Computer

Atari 400 or 800 with 8K bytes of RAM and joysticks

Documentation

18-page booklet

Audience

Any Atari computer owner who enjoys a good game

BYTE'S ARCADE

satellites that drop missiles, bombers, and smart missiles that can evade your ABMs and home in on their targets.

The enemy attacks come in waves. Each wave lasts from 30 to 45 seconds. The waves become increasingly more difficult as the game progresses, with the sixth wave introducing you to the smart missiles.

You are provided with 30 ABMs per wave. These are launched against targets by using the joystick to control a cursor on the screen. When a missile, bomber, or satellite appears, you position the cursor over or near the target and press the fire control button. Your missile base launches an ABM toward a detonation mark left by the cursor on the screen. The resulting atomic fireball, complete with the simulated sound of a nuclear explosion, will destroy the incoming missile or other target. That is, if your aim was true, if you allowed for a moving target, if you hadn't already used all your ABMs, and if the target wasn't smart enough to get out of your way (smart missiles).

The game allows you to select one or two players. The computer automatically keeps score and remembers the highest score while the game is continuing. You have the option of skipping the easier waves of



Photo 1: *Missile Command*, one of the most popular coin-operated arcade games, is now available in a cartridge for the Atari 400 and 800 microcomputers. The trackball of the coin-operated version has been replaced by an Atari joystick. Also, you have only one missile base (not three), but the sights, sounds, and action of the original game are still there.

Every two waves, a wave point multiplier increases the value of each point by as much as six times. Every time you earn 10,000 points, you get another city to replace one that was previously vaporized.

Why Is It Successful?

Though none of the editors on the BYTE staff advocate nuclear war, we all agree that *Missile Command* is a good game. Yet we agree for different reasons, and therein lies the reason for the game's success.

Some people enjoy the competitiveness of trying to better another person's score. Others enjoy the interaction between human and computer. And some enjoy the lights, noise, and the satisfaction of symbolically blowing things up. My enjoyment stems mostly from not having to pump quarters into the computer.

The Critics

There are those who object to the overt violence implicit in the game. After all, the destruction of cities is a very violent activity. A friend of mine once said that games of this type only encourage the acceptance of warfare as a viable solution to problems that could be settled peaceably. I asked if he ever played chess.

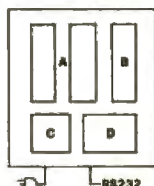
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When he said yes, I then asked if he thought his aggressive activities on the chessboard affected his actions in real life. A very spirited discussion then ensued, with neither of us convincing the other to change his views.

Whether the designers of Missile Command intended to or not, they have presented a game that reflects contemporary society. The game takes the threat of nuclear warfare and, simplifying the concept to the extreme, reduces that threat to a man-

ageable human level. Whether this familiarity with nuclear warfare is good or not, I don't know. However, it doesn't seem to have affected the popularity of the game.

Conclusion

Missile Command is a great success, and Atari should be congratulated on producing such a high-quality product. However, it is only a temporary success. Programmers are constantly working on newer, better

games. My advice to them is to carefully examine the current successes and determine why they work. Then, taking their own original games, incorporate those ideas in their own programs.

With the advent of new microcomputers and with the foundations for software development already well established, the potential for creative programming is greater than ever. I am excitedly awaiting what's coming next. ■

Dino Wars

George Stewart
Technical Editor

If any computer game deserves the title "action game," this one does. Dino Wars is a two-player game in which each player controls a ferocious dinosaur that attempts to bite the other player's dinosaur until it cries uncle. Although there is no gore and the losing dinosaur always survives, the combat between the two creatures seems vicious at times.

The battle takes place on a desert plain decorated with several clumps of cactus. However, this is not your ordinary cactus. If a dinosaur mistakenly runs into one, the creature falls over and loses five units of fighting energy. Perhaps it's fossilized.

Although the terrain is much larger than the field of view displayed on the screen, it is not infinite. If a dinosaur exits to either the left or the right, it eventually reemerges on the opposite side of the screen. Even if not visible on the screen, battles can rage in full force and dinosaurs can trip over unseen cacti.

The dinosaurs are chunky creatures (low-resolution is the term used outside of the prehistoric epoch) modeled after *Tyrannosaurus rex*. One is purple, the other blue. (An alternate color set is available for variety.) Although not the most graceful of animals, they can swing their tails menacingly, open their jaws to bite, and swagger around the screen in any direction.

The game is three-dimensional. As a dinosaur recedes into the background, it becomes smaller, eventually shrinking to the size of a dot. As it advances, its size increases to a stage where it consumes much of the screen.

Joysticks are used to control the combatants. Although these joysticks permit 360 degrees of apparent control, the dinosaurs can actually move in only six directions. As a result, they appear to hop from one stance to another.

The object of the game is to bite the

At a Glance

Name

Dino Wars

Type

Animated dinosaur combat game

Manufacturer

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

Price

\$39.95

Author

Robert Kilgus

Format

Plug-in ROM cartridge

Computer

TRS-80 Color Computer with two joystick controllers; 16K bytes of RAM recommended for best results

Audience

Game fans age 6 and up

The Atari Tutorial

Part 7: Sound

Bob Fraser
1639 Martin Ave.
Sunnyvale, CA 94087

The Atari 400 and 800 home computers have extensive hardware sound capabilities. Four independently controllable sound channels are able to play simultaneously. Each channel has a frequency register determining the note and a control register regulating the volume and the noise content. Several options allow you to insert high-pass filters, choose clock bases, set alternate modes of operation, and modify polynomial counters. This article will explain these options; next month, part 8 will show how to call these options from both BASIC and 6502 machine language.

Definitions

For the purposes of this discussion, a few terms and conventions need to be clarified:

1 Hz (hertz)	is 1 pulse per second
1 kHz (kilohertz)	is 1000 pulses per second
1 MHz (megahertz)	is 1,000,000 pulses per second

A *pulse* is a sudden voltage rise followed somewhat later by a sudden voltage drop. If a pulse is sent to a

television speaker, it will be heard as a single pop.

A *wave*, as used here, is a continuous series of pulses. Different types of waves exist, each of which is distinguished by the shape of the in-

**The smaller poly
counters repeat often
enough to create
droning sounds that
rise and fall quickly.**

dividual pulses. Waves created by the Atari computer are square. Brass instruments typically produce triangular waves, and a human voice produces sine waves.

A *shift register* is like a memory location (in that it holds binary data) that, when so instructed, shifts all its bits to the right by one position (i.e., bit 5 will get whatever was in bit 4, bit 4 will get whatever was in bit 3, and so on). Thus, the rightmost bit is pushed out, and the leftmost bit assumes the value on its input wire (see figure 1).

"AUDFn" is read "any of the audio frequency registers, AUDF1 through AUDF4." Their addresses are, respectively, hexadecimal D200, D202,

D204, and D206 (decimal 53760, 53762, 53764, and 53766).

"AUDCn" is read "any of the audio control registers, AUDC1 through AUDC4." Their addresses are, respectively, hexadecimal D201, D203, D205, and D207 (decimal 53761, 53763, 53765, and 53767).

For the purposes of this discussion, *frequency* is a measure of the number of pulses in a given amount of time; that is, a note with a frequency of 100 Hz means that in one second exactly 100 pulses will occur. The more frequent (hence, "frequency") the pulses of a note, the higher the note. For example, a singer vocalizes at a high frequency (5 kHz), and a cow moos at a low frequency (100 Hz). The words "frequency," "note," "tone," and "pitch" are used interchangeably.

Noise and distortion are also used interchangeably, although their meanings are not the same. Noise is a more accurate description of the function performed by the Atari computer.

All examples are in BASIC unless

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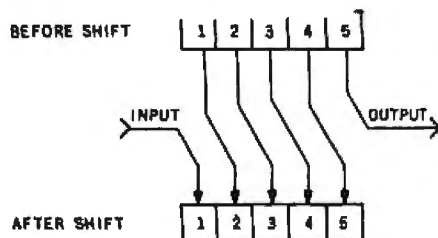


Figure 1: Operation of a shift register. Here, all bits are shifted one bit to the right. As the rightmost bit is lost, some external value fills the leftmost bit.

otherwise stated. Type the examples *exactly as they appear*. If there are no line numbers, don't use any; if several statements are on the same line, type them as such.

Sound Hardware

Sound is generated in the Atari computer by the POKEY chip, a custom integrated circuit designed especially for the Atari 400 and 800; POKEY also handles the serial I/O bus and the keyboard. The POKEY chip must be initialized before it will work properly. Initialization is required after any serial bus operation (cassette, disk drive, printer, or RS-232C read/write). To initialize POKEY in BASIC, execute a null sound statement; that is, SOUND 0,0,0,0. In machine language, store a 0 at AUDCTL (hexadecimal D208 = decimal 53768) and a 3 at hexadecimal 232 (decimal 562); this is the shadow location for the SKCTL register at hexadecimal D20F (decimal 53775).

The Audio Frequency Registers

Each of the four audio channels has a corresponding frequency register that controls the note played by the computer. The frequency register contains the number N used in a divide-by- N circuit. This is not a division in the mathematical sense, but something much simpler: for every N

pulses coming in, one pulse goes out. For example, figure 2 shows a divide-by-4 function.

As N gets larger, output pulses become less frequent, making a lower frequency note.

The Audio Control Registers

Each channel also has a corresponding control register. These registers allow the volume and distortion content of each channel to be set. The bit assignment for AUDCn is given in table 1.

Volume

The volume control for each audio channel is straightforward. The lower 4 bits of the audio-control register (AUDCn) contain a 4-bit number that specifies the volume of the sound. A zero in these bits means zero volume; a fifteen means as loud as possible. The sum of the volumes of the four channels should not exceed thirty-two because this forces overmodulation of the audio output. The sound produced tends to actually lose volume and assume a buzzing quality.

Distortion

Table 1 also shows that each channel has three distortion-control bits in its audio-control register. Distortion is used to create special sound effects any time a pure tone is undesirable.

AUDCn Bit Number	7	6	5	4	3	2	1	0
Use	distortion			volume-only bit	volume			

Table 1: Bit usage in the AUDCn registers (AUDC1 through AUDC4).

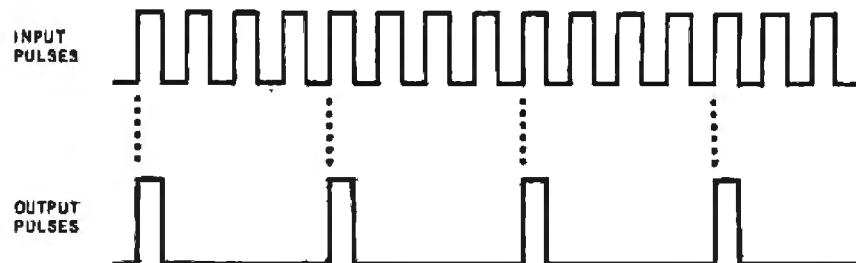


Figure 2: An example of a divide-by-4 process. The circuitry for this process allows only every fourth pulse to pass through.

The computer's use of distortion offers great versatility and control. It is easy to synthesize an almost endless variety of sounds, from rumbles, rattles, and squawks to clicks, whispers, and mood-setting background tempos.

Distortion, as used here, is not equivalent to the standard interpretation. For example, *intermodulation distortion* and *harmonic distortion* are quality criteria specified for high-fidelity stereo systems. These types of distortion refer to waveform degeneration, where the shape of the wave is slightly changed due to error in the electronic circuitry. The computer's distortion does not alter waves (they are always square), but rather deletes selected pulses from the waveform. This technique is not adequately characterized by the word "distortion." A more descriptive and appropriate term for these distortion methods is "noise."

Before you can fully grasp what we

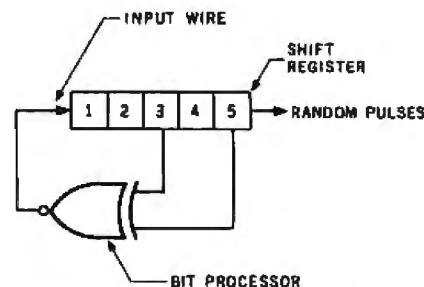


Figure 3: An example of a poly counter. By letting the new leftmost bit be determined by some algorithm (here, an exclusive NOR of bits 3 and 5), a poly counter can produce a semirandom stream of bits. The pattern of the bits will eventually repeat, but the length of the pattern depends on the width in bits of the poly counter.

mean by distortion, you must understand *polynomial counters* (also called *poly counters*). Poly counters are employed in the Atari computer as a source of random pulses used in noise generation. The Atari computer's poly counters utilize a shift register working at 1.79 MHz. The shift register's contents are shuffled and fed back into the input; this produces a semirandom sequence of bits at the output of the shift register.

For example, in figure 3, the old value of bit 5 will be pushed out of the shift register to become the next output pulse, and bit 1 will become a function of bits 3 and 5.

The bit processor gets values from certain bits in the shift register (in figure 3, bits 3 and 5) and processes them in a way irrelevant to this discussion. It yields a value that becomes bit 1 of the poly counter's shift register.

These poly counters are not truly random because they repeat their bit sequence after a certain span of time. As you might suspect, their repetition rate depends upon the number of bits in the poly counter; in other words, the longer ones require many cycles before they repeat, while the shorter ones repeat more often.

On the Atari computer, distortion is achieved by using random pulses from these poly counters in a *selection circuit*. This circuit is actually a digital comparator, but the term "selection circuit" is more descriptive. The only pulses making it through the selection circuit to the output are those coinciding with a random pulse. Various pulses from the input are thereby eliminated in a random fashion. Figure 4 illustrates this selection method. A dotted line connects pulses that coincide.

The net effect is this: some pulses from the frequency-divider circuit are deleted. Obviously, if some of the pulses are deleted, the note will sound different. This is how distortion is in-

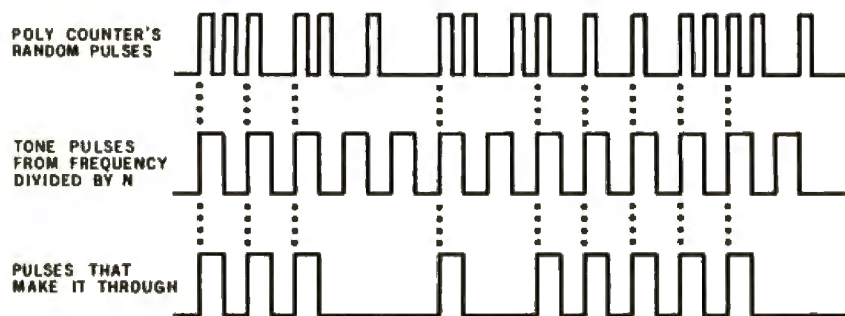
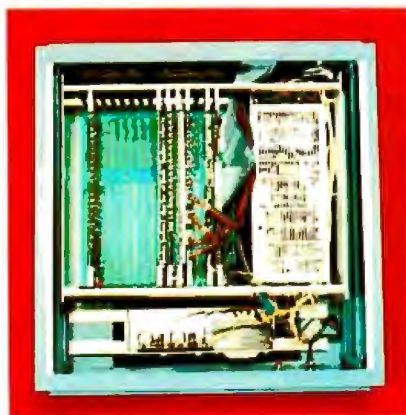


Figure 4: Using the output of a poly counter to create a noisy tone. The resulting sound of the output pulse train is considerably modified by using the poly counter output to select pulses from a pure square-wave input.

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troduced into a sound channel.

Because poly counters repeat their bit sequences, their output pattern of pulses is cyclic. And since the selection circuit uses this output pattern to delete pulses from the original note, the distorted note will contain the same repetitious pattern. This allows the hardware to create noises such as drones, motors, and other sounds having repetitive patterns.

The Atari computer is equipped with three poly counters of different lengths, which can be combined in many ways to produce interesting sound effects. The smaller poly counters (4 and 5 bits long) repeat often enough to create droning sounds that rise and fall quickly; the larger poly counter (17 bits long) takes so long to repeat that no pattern to the distortion can be readily discerned. This 17-bit poly counter can be used to generate explosions, steam, and any sound where random crackling and popping is desired. It is even irregular enough to generate *white noise* (an audio term meaning a hissing sound).

Each audio channel offers six distinct combinations of the three poly counters, which are listed in table 2. These upper AUDCn bits control three switches in the audio circuit as shown in figure 5. This diagram will help you understand why table 2 is structured as it is.

Each combination of the poly counters offers a unique sound. Furthermore, the distorted sounds can sound quite different at different frequencies. For this reason, some trial and error is necessary to find a combination of distortion and frequency that produces the desired sound effect. Table 3 gives you some rough guidelines with which you can begin your experimentation.

Volume-only Sound

Bit 4 of AUDCn specifies the volume-only mode. When this bit is set, the volume value in AUDCn bits 0 through 3 is sent directly to the television speaker; it is not modulated with the frequency specified in the AUDFn registers.

To fully understand the use of this

mode of operation, you must understand how a speaker works and what happens to the television speaker when it receives a pulse. Any speaker has a cone that moves in and out. The cone's position at any time is directly proportional to the voltage it is receiving from the computer at that

time. If the voltage sent is zero, the speaker is in the resting position. Whenever the cone changes position, it moves air that is detected by your ear as sound.

From our definition of a pulse, you know that it consists of a rising voltage followed by a falling voltage.

AUDCn Bit Type of Distortion Carried Out

7	6	5	Type of Distortion Carried Out
0	0	0	Divide clock by frequency, select using 5-bit then 17-bit poly counter, then divide by 2
0	X	1	Divide clock by frequency, select using 5-bit poly counter, then divide by 2
0	1	0	Divide clock by frequency, select using 5-bit then 4-bit poly counter, then divide by 2
1	0	0	Divide clock by frequency, select using 17-bit poly counter, then divide by 2
1	X	1	Divide clock by frequency, then divide by 2 (no poly counters used)
1	1	0	Divide clock by frequency, select using 4-bit poly counter, then divide by 2

Table 2: Types of distortion available from the Atari 400/800. See table 1 for the usage of other bits in each AUDCn register. An "X" in the second column of the table represents a bit that can be either 0 or 1.

AUDCn Bit	7	6	5	Examples of Resulting Sound
				Low frequencies Middle frequencies High frequencies
0	0	0	0	Geiger counter raging fire rushing air steam
0	X	1	1	machine gun auto at idle electric motor power transformer
0	1	0	0	calm fire laboring auto auto with a "miss"
1	0	0	0	building crashing in radio interference waterfall
1	X	1	1	pure musical tones
1	1	0	0	airplane lawn mower electric razor

Table 3: Types of sounds available from the six types of distortion available from each AUDCn register. An "X" in the second column of the table represents a bit that can be either 0 or 1.

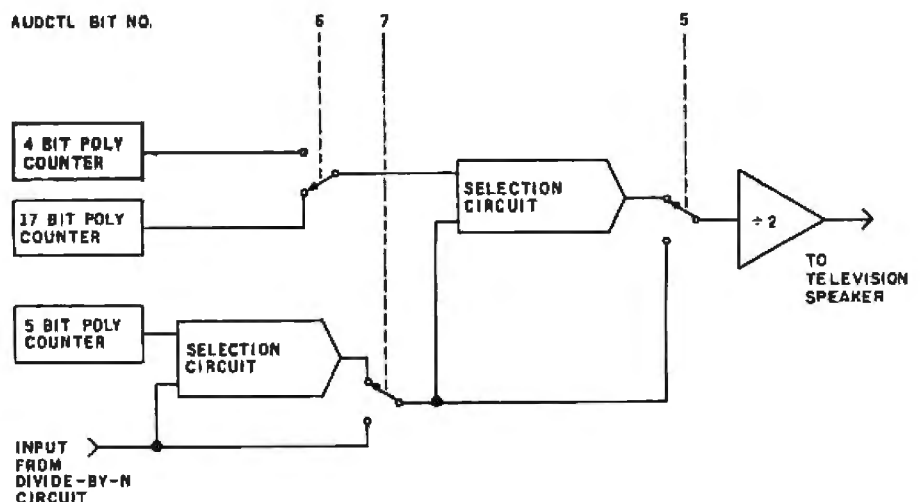


Figure 5: A schematic representation of the effects of bits 5 through 7 of the AUDCTL register on the sound sent to the television speaker.

If you sent the speaker a pulse, it would push out with the rising voltage and pull back with the falling voltage, resulting in a wave of air that can be detected by your ear as a pop. The following statements produce such a pop on the television speaker by sending a single pulse:

POKE 53761,31:POKE 53761,16

A stream of pulses (or wave) would set the speaker into constant motion, and a continuous buzz or note would be heard. The faster the pulses are

sent, the higher the note. This is how the computer generates sound on the television speaker.

It is essential to note that in the volume-only mode the volume sent does not drop back to zero automatically, but remains constant until the program changes it. The program should modulate the volume often enough to create a noise. Now try the following two statements, listening carefully after each:

POKE 53761,31
POKE 53761,31

The first time you heard a pop, as expected. The speaker pushed out and moved air. But the second time you didn't because the speaker cone was already in the extended position; an identical extension command did nothing to the speaker. Since it moved no air, you heard nothing. Now try this:

POKE 53761,16
POKE 53761,16

As before, you heard a pop the first time as the speaker moved back to its resting position, and you heard nothing the second time because the speaker was already in the resting position.

Thus, the volume-only bit gives the program complete control over the position of the speaker at any time. Although the examples given above are only binary examples (either on or off), you are by no means limited to this type of speaker modulation. You can set the speaker to any of 16 distinct positions.

For example, a simple triangle wave (similar to the waveform produced by brass instruments) could be generated by sending a volume of 8 followed by 9, 10, 11, 10, 9, 8, 7, 6, 5, 6, 7, and back to 8, then repeating this sequence over and over very rapidly. By changing the volume quickly enough, virtually any waveform can be created. It is feasible, for example, to perform voice synthesis using this technique. However, this requires the use of assembly language. There is more discussion of this bit in part 8 of this series.

AUDCTL

In addition to the independent channel-control bytes (AUDCn), an option byte (AUDCTL) affects all four channels. Each bit in AUDCTL is assigned a specific function, as shown in table 4. AUDCTL is at location D208 hexadecimal, 53768 decimal.

Clocking

Before proceeding with the explanations of the AUDCTL options, a

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AUDCTL Bit	Function Performed If Bit Set
0	Switches the main clock base from 64 kHz to 15 kHz
1	Inserts high-pass filter into channel 2, clocked by channel 4 (only frequencies higher than that of channel 4 are passed by the filter)
2	Inserts high-pass filter into channel 1, clocked by channel 3 (only frequencies higher than that of channel 3 are passed by the filter)
3	Joins channel 4 to channel 3 to give 16-bit resolution
4	Joins channel 2 to channel 1 to give 16-bit resolution
5	Clocks channel 3 with 1.79 MHz
6	Clocks channel 1 with 1.79 MHz
7	Makes the 17-bit poly counter into a 9-bit poly counter

Table 4: Modifications to the sound-generation registers available by manipulation of the bits in register AUDCTL (location D208 hexadecimal, 53768 decimal). Bit 7 is the most significant bit in the register.

new concept must be explained: clocking. In general, a clock is a train of pulses used to synchronize the millions of internal operations occurring every second in any computer. The central clock pulses continuously, each pulse telling the circuitry to perform another step in its operations. You may remember that a divide-by-N frequency divider outputs one pulse for every Nth input

pulse. You also may have wondered where the input pulses come from. One main input clock runs at 1.79 MHz; it can provide the input pulses. Also, several secondary clocks can be used as input clocks. The AUDCTL register allows you to select the clock used as the input to the divide-by-N circuit. If you select a different input clock, the output from the frequency divider will change drastically.

For example, imagine that you are using the 15-kHz clock, with the frequency register set to divide by 8. The rate of output pulses from the divide-by-N circuit would be about 2 kHz. But if you changed the selection of clocks to get the 64-kHz clock and did not change the frequency register, what would happen? The divide-by-N would still be putting out one pulse for every eighth input pulse, but the input rate would be 64 kHz. The result is an output frequency (from the divide-by-N) of 8 kHz. Thus, you can see that reclocking changes the frequency independent of the frequency register and on a larger scale.

The formula for the output frequency (from the divide-by-N) is quite simple:

$$\text{Output frequency} = \frac{\text{Clock}}{N}$$

Setting bit 0 of the AUDCTL register switches from the 64-kHz clock to the 15-kHz clock. Note that if this bit is set, every sound channel clocked with the 64-kHz clock will instead use the 15-kHz clock. Similarly, by setting bits 5 or 6, you can clock channels 3 or 1, respectively, with 1.79 MHz. This will produce a much higher note, as demonstrated by the following example:

SOUND 0,255,10,8
POKE 53768,64

The SOUND statement causes channel 1 to give a low tone, and the POKE sets AUDCTL bit 6 to 1, causing the pitch generated by channel 1 to jump to a much higher note.

16-Bit Frequency Options

The 8 bits of resolution in the frequency-control registers normally provide more than adequate resolution for the task of selecting any desired frequency. There are, however, situations in which 8 bits are inadequate. Consider what happens when you execute the following statements:

```
FOR I=255 TO 0 STEP -1:
  SOUND 0,I,10,8:NEXT I
```

Initially, the sound rises smoothly,

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A0A0C2D9A0CAC5D2D2D9A0D4C9C6C6D4A0A0

Listing 1: A program that uses a 16-bit divide-by-N register. When used with game paddles in port 1, this program produces a sound with a frequency that can be varied by paddles 1 and 2. Paddle 1 changes the sound in large steps; paddle 2 changes the sound between two adjacent large steps.

```
10 SOUND 0,0,0,0; REM
20 POKE 53768,80: REM

30 POKE 53761,160:POKE 53763, 168: REM

40 POKE 53760,PADDLE(0):POKE 53762,PADDLE(1)
50 GOTO 40: REM
```

Initialize sound
Clock channel 1 with 1.79 MHz, clock channel 2 with channel 1
Turn off channel 1, turn on channel 2 (pure tones)
Set paddles to put frequencies in frequency registers

but as it approaches the end of its range the frequency takes larger and larger steps that are noticeably clumsy. This happens because you are dividing the clock by smaller and smaller numbers: 15 kHz divided by 255 is almost the same as 15 kHz divided by 254; however, 15 kHz divided by 2 differs greatly from 15 kHz divided by 1. The only way to solve this problem is to use a larger number that allows you to specify frequency with greater precision. The means to do this are built into POKEY.

AUDCTL bits 3 and 4 allow two channels to be joined, creating a single channel with an extended dynamic-frequency range. Normally, each channel's frequency-divider number can range from 0 to 255 (which results from 8 bits of divide-by-N capability). Joining two channels allows a frequency range of 0 to 65535 (16 bits of divide-by-N capability). In this mode, it is possible to reduce the output frequency to less than 1 Hz. The program in listing 1 uses two channels in the 16-bit mode and two paddles as the frequency inputs. Insert a set of paddles into port 1, then type in and run listing 1. The right paddle tunes the sound coarsely; the left paddle finely tunes the sound between the coarse increments.

This program first sets bits 4 and 6 of AUDCTL; this tells the Atari computer to clock channel 1 with 1.79 MHz and join channel 2 to channel 1. Once this happens, the 8-bit frequency registers of both channels are assumed to represent a single 16-bit number N that is used to divide the input clock. Next, the volume of

channel 1 is set to 0. Since channel 1 no longer has its own direct output, its volume setting is meaningless to us and we zero it. The channel 1 frequency register is used as the fine-tuning or low byte in the sound generation; the channel 2 frequency register is the coarse-tuning or high byte. For example, poking a 1 into the channel 1 frequency register makes the pair of registers divide by 1. Poking a 1 into the channel 2 frequency register makes the pair divide by 256. Poking a 1 into both frequency registers makes the pair divide by 257.

Bit 3 of AUDCTL can be used to join channel 4 to channel 3 in the same way.

The following instructions demonstrate some interesting aspects of 16-bit sound (try poking other numbers into the last four locations):

```
SOUND 0,0,0,0
POKE 53768,24
POKE 53761,168
POKE 53763,168
POKE 53765,168
POKE 53767,168
POKE 53760,240
POKE 53764,252
POKE 53762,28
POKE 53766,49
```

High-Pass Filters

AUDCTL bits 1 and 2 control high-pass filters in channels 2 and 1, respectively. A high-pass filter allows only higher frequencies to pass through. In the case of these high-pass filters, high frequencies are defined as anything higher than the output of another channel selected by

the AUDCTL bit combination. For example, if channel 3 is playing a cow's moo and AUDCTL bit 2 is set, only sounds with frequencies higher than the moo will be heard on channel 1 (anything lower than the "moooo" will be filtered out). See figure 6.

The filter is programmable in real time because the filtering channel can be changed on the fly. This opens a large field of possibilities to the pro-

grammer. The filters are generally used to create special effects. Try the following statements:

```
SOUND 0,0,0,0
POKE 53768,4
POKE 53761,168:POKE 53765,168
POKE 53760,254:POKE 53764,127
```

9-Bit Polynomial Conversion

Bit 7 of AUDCTL, when set, turns the 17-bit poly counter into a 9-bit

poly counter. The shorter the poly counter, the more often its distortion pattern repeats, or the more discernible is the pattern in the distortion. Therefore, changing the 17-bit poly counter into a 9-bit poly counter makes the noise pattern more repetitious and more discernible. Try the following demonstration of the 9-bit poly-counter option, listening carefully when the POKE is executed:

```
SOUND 0,80,8,8
POKE 53768,128
```

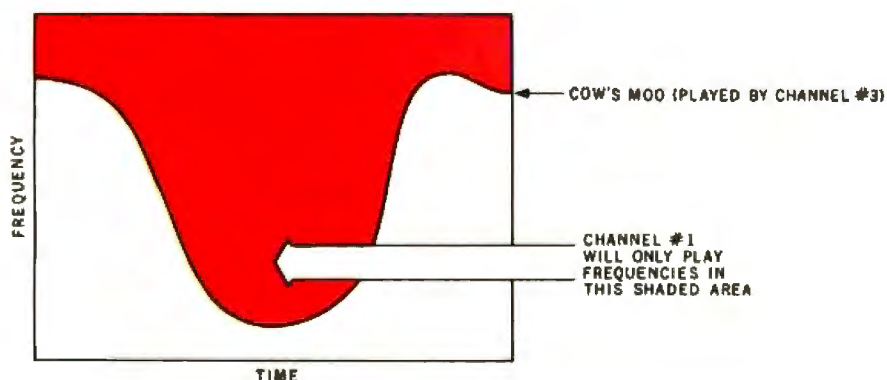


Figure 6: High-pass filtering in the Atari 400/800. At any given instant, the only frequencies in channel 1 that are passed by the filter are those greater than the frequency being played in channel 3.

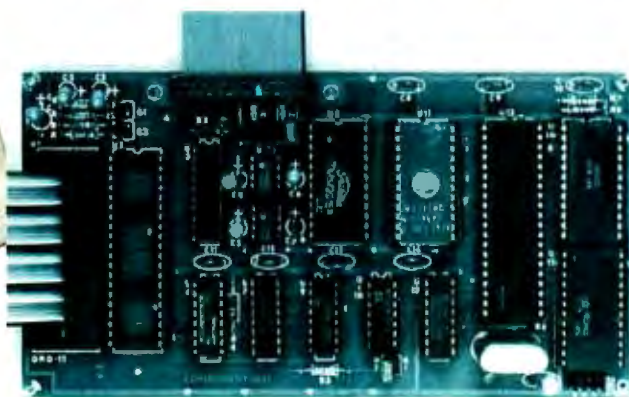
The first statement activates the 17-bit poly counter; the second changes the counter to a 9-bit poly counter.

Next Month

Now that we know about the various registers that control the sound-generating capabilities of the Atari 400/800, we will look at several BASIC and machine-language techniques to use sound within a program. ■

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Software Received

Apple

Adventure in Time, an adventure game for the Apple II. Floppy disk, \$29.95. Phoenix Software Inc., 64 Lake Zurich Dr., Lake Zurich, IL 60047.

Birth of the Phoenix, a tutorial adventure for the Apple II. Floppy disk, \$14.95. Phoenix Software Inc. (see address above).

Circuit Design System, a digital electronics design and simulation package for the Apple II. Floppy disk, \$149. Smart Software Co., POB 1292, Orem, UT 84057.

Comma Usage/Semicolon and Colon Usage, a punctuation usage tutorial for the Apple II. Cassette, \$20; floppy disk, \$25. LARA Software, 980 Hunting Valley Pl., Decatur, GA 30033.

Context Connector, a Visicalc utility program for the Apple II. Floppy disk, \$180. Context Management Systems Inc., 23864 Hawthorne Blvd., Torrance, CA 90505.

Datalink, a telecommunications package in Pascal for the Apple II. Floppy disk, \$100. Link Systems, 1655 26th St., Santa Monica, CA 90404.

Linkdisk, a disk-utility package in Pascal for the Apple II. Floppy disk, \$70. Link Systems (see address above).

Linkindex, a rapid key data-file retrieval system in Pascal for the Apple II. Floppy disk, \$150. Link Systems (see address above).

Link sampler, a tutorial package in Pascal for the Apple II. Floppy disk, \$60. Link Systems (see address above).

Linkvideo, a screen utility in Pascal for the Apple II. Floppy disk, \$55. Link Systems (see address above).

Red Alert, an arcade-style game for the Apple II Plus. Floppy disk, \$29.95. Bröderbund Software Inc., 2 Vista

Wood Way, San Rafael, CA 94901.

Shadow Hawk One, an arcade-style game for the Apple II. Floppy disk, \$49.95. Horizon Simulations, 107 East Main #2, Medford, OR 97501.

Zoom Grafix, a graphics/prINTER control package for the Apple II. Floppy disk, \$39.95. Phoenix Software Inc. (see address above).

Atari

Easytext Word Processor, a word-processing system for the Atari 800. Floppy disk, \$50. Dataworks Inc., 97 Jackson St., Cambridge, MA 02140.

The I Ching, a program for casting and displaying hexagrams for the Atari 800. Floppy disk, \$44.95. Alternate Reality Software, 2111 West Arapahoe Dr., Littleton, CO 80120.

Shadow Hawk One, an arcade-style game for the Atari 400/800. Floppy disk, \$49.95. Horizon Simulations, 107 East Main #2, Medford, OR 97501.

CP/M

Office System 80, a utility system for the CP/M operating system. 8-inch floppy disk, \$195. The Information People, 443 Hudson Ave., Newark, OH 43055.

Quickscreen, a screen-formatting program for the CP/M operating system. 8-inch floppy disk, \$149. Fox and Geller Associates Inc., POB 1053, Teaneck, NJ 07666.

The Formula, a multifunctioned, business-oriented data-processing package for CP/M. 8-inch floppy disk, \$595. Dynamic Microprocessor Associates, 545 5th Ave., New York, NY 10017.

XLT86, an assembly-lan-

guage conversion utility to convert CP/M programs to CP/M-86. 8-inch floppy disk, \$150. Digital Research Inc., 801 Lighthouse Ave., POB 579, Pacific Grove, CA 93950.

TRS-80

LOG, a simple database management program for the TRS-80 Models I and III. Floppy disk, \$44.95 (Model I), \$49.95 (Model III). KSoft, 318 Lakeside Dr., Brandon, MS 39042.

Modem 80, a telecommunications software package for the TRS-80 Models I and III. Floppy disk, \$39.95. The Alternate Source, 1806 Ada St., Lansing, MI 48910.

Smart Terminal, a telecommunications software package for the TRS-80 Models I and III. Cassette, \$69.95.

Howe Software, 14 Lexington Rd., New City, NY 10956.

Uniterm, a telecommunications software package for the TRS-80 Models I and III. Floppy disk, \$29.95. BT Enterprises, 171 Hawkins Rd., Centereach, NY 11720.

Other Computers

Quadcube, an extended graphics simulation of the Rubik cube puzzle for the Texas Instruments TI-99/4. Cassette, \$14.95. Linear Aesthetic Systems, POB 23, West Cornwall, CT 06796.

The ZX80 Business Package, a business-oriented program package for the ZX80 and MicroAce computers. Cassette, \$9.95. Lamo-Lem Laboratories, POB 2382, La Jolla, CA 92038. ■

This is a list of software packages that have been received by BYTE Publications during the past month. The list is correct to the best of our knowledge, but it is not meant to be a full description of the product or the forms in which the product is available. In particular, some packages may be sold for several machines or in both cassette and floppy-disk format; the product listed here is the version received by BYTE Publications.

This is an all-inclusive list that makes no comment on the quality or usefulness of the software listed. We regret that we cannot review every software package we receive. Instead, this list is meant to be a monthly acknowledgment of these packages and the companies that sent them. All software received is considered to be on loan to BYTE and is returned to the manufacturer after a set period of time. Companies sending software packages should be sure to include the list price of the packages and (where appropriate) the alternate forms in which they are available.

BYTE's Bugs

Closer Look Spies Bug

PC: The Independent Guide to the IBM Personal Computer is a bimonthly publication, not a monthly as stated on page 60 of Gregg Williams' article "A Closer Look at the IBM Personal Computer" (January 1982 BYTE). Subscriptions to the

magazine cost \$12 for six issues.

Please note that the new address for *PC: The Independent Guide to the IBM Personal Computer* is 1239 21st Ave., San Francisco, CA 94122, (415) 753-8088. ■

What's New?

14478 Giorietta Dr., Sherman Oaks, CA 91423, (213) 986-4885.
Circle 569 on inquiry card.

Atari Graphics Composer

The Graphics Composer is a joystick/paddle graphics software package for Atari 400/800 microcomputers. With it you can draw the outline of a picture in high-resolution screen mode 8 or 7 using a joystick or paddle; then you can use color fill-in, color brushes, and text to complete your graphics scheme. The graphics can then be saved to disk or cassette.

Graphics Composer is supplied with a Geometric Figures program that allows you to define circles, triangles, polygons, parallelograms, and trigonometric curves. Graphics Composer is available in both cassette and disk versions for \$39.95. It requires 32K bytes of programmable memory. Contact Versa Computing Inc., Suite 104, 3541 Old Conejo Rd., Newbury Park, CA 91320, (805) 498-1956.

Circle 570 on inquiry card.

New C Compiler

Phase One Systems has unveiled a C compiler for its Oasis operating system. Oasis C supports most Unix Version Seven C features. It produces Z80 assembler code and is provided with an optimizer that reduces compiled code between 30 and 50%. Among the attributes of Oasis C are

pointers, structures, assignment operators, a full I/O (input/output) library, and compile options. A version of Oasis C for the 16-bit-compatible Oasis-16 will be available.

Oasis C costs \$250. For complete details, contact Phase One Systems Inc., Suite 830, 7700 Edgewater Dr., Oakland, CA 94621, (415) 562-8085.

Circle 571 on inquiry card.

PERIPHERALS

Model III Cash-Register Expansion System

The CR-180 is a cash register/point-of-sale expansion system for the TRS-80 Model III microcomputer. It stores transactions for up to 100 employees, saves eight methods of payments, and provides inventory control and complete reporting. The CR-180 can produce daily sales and cash reports by employee and by type of transaction. Inventory usage reports, and gross profit computation. Also, price and shelf labels can be printed.

The CR-180 expansion system is supplied with an electronic cash drawer and a receipt printer which plug directly into the TRS-80 Model III. Audio has been added for keystroke confirmation. Prices range from \$900 to \$1900. Contact Integrated Cash Register/Futuresoft, Southern Region, Suite 203, 2301 Park Ave., POB 1446, Orange Park, FL 32073, (904) 269-1918.

Circle 572 on inquiry card.



Draft- and Letter- Quality Printer

Printer Systems' Model 1800 printer can produce both correspondence- and draft-quality printouts. It is plug-compatible with IBM Series I or System 34/38 computers as well as Univac, Burroughs, Honeywell, DEC (Digital Equipment Corp.), and Data General computers. In the draft mode, the Model 1800 prints at 200 cps (characters per second) with a 7 by 9 dot-matrix format. In the correspondence mode, it prints at 50 cps in a 40 by 18 format. The Model 1800 features a forms-length selector switch and quiet operation.

The Model 1800 printer is available for \$2695 from Printer Systems Corp., Suite 104, 1 West Deer Park Rd., Gaithersburg, MD 20760, (301) 840-1070.

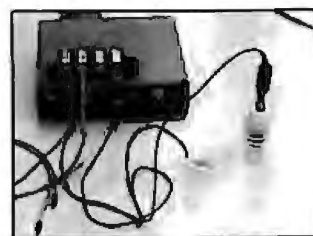
Circle 573 on inquiry card.

I/O Control Card

The G519 I/O card is an interface between the Multibus and Gordos industry-standard PB-16/PB-24 I/O (input/output) module boards. The card

can control up to 72 AC or DC input or output modules in any combination or position on the I/O module board. It can also serve as a general-purpose TTL (transistor-transistor logic) interface card for control of up to 72 bidirectional I/O lines.

Gordos International also has interface cards for the RM-65, the Exorcisor II, and STD bus. The G519 I/O card is priced at \$500. For details, contact Gordos Corp., 250 Glenwood Ave., POB 100, Bloomfield, NJ 07003, (201) 743-6800. Circle 574 on inquiry card.



Analog Peripheral

The Analog Peripheral is a self-contained 8-bit A/D (analog-to-digital) converter that can connect to any computer. It has a switch-selectable RS-232C output line with data transmission rates from 110 to 9600 bps (bits per second). Other features include a 26-pin parallel output, four input channels, conversion speeds of 100 microseconds, power supply, and plug-in sensors for temperature, light and other analog signals. For complete details on the Analog Peripheral, contact Cambridge Development Laboratory, 36 Pleasant St., Watertown, MA 02172, (617) 926-0869.

Circle 575 on inquiry card.

sonal bias and technical incompetence in the designers. All responses to this review step must be dealt with before the standard can be established. The draft standard need not be modified for every response, since some of them will themselves be biased or incompetent, but all responses must be considered.

The American National Standards Institute (ANSI) and the IEEE, as a member of ANSI, are set up to develop standards

by these procedures, and the standards so developed do receive wide public acceptance. Although it is still being reviewed and revised, the proposed standard for the S-100 bus is an example of such success.

What about the wrong way? Usually it is some variety of "Let's standardize on my way of doing it." A lot of standards are proposed this way, and some actually succeed. If they succeed, it is in spite of the attitude, not because of it, and then only because the proposer has done the

technical homework and controls the marketplace (for example, IBM, which is known for this attitude).

How does DIF fit in? [Editor's Note: DIF, for Data Interchange Format, is a method for representing data in a program so that it can be transported directly to other programs. See "DIF: A Format Between Applications Programs" by Candace E. Kalish and Malinda F. Mayer, November 1981 BYTE, page 174.] Software Arts is promoting DIF as a standard, using the "let's do it my way" approach. It may succeed at this, because Visicalc happens to dominate the market. It may even be that DIF is a good technical proposal, but we cannot know this without the proper review procedures, which Software Arts has bypassed.

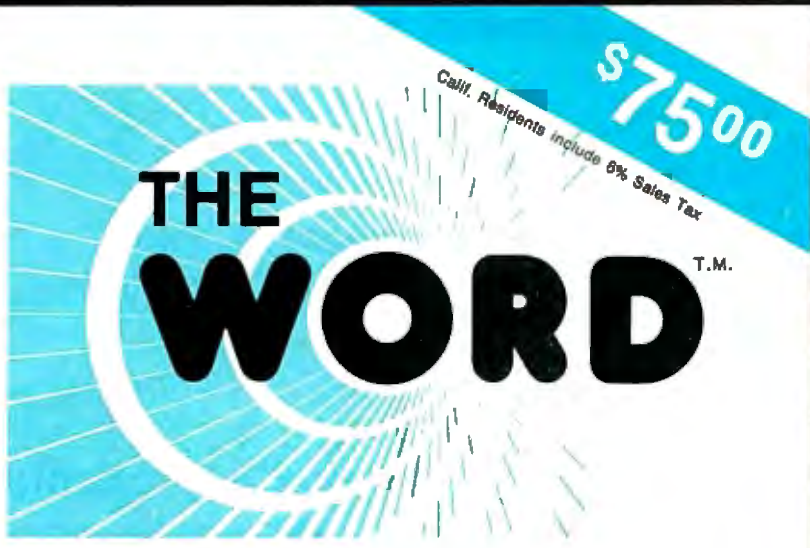
I think it is unfortunate that monopoly industries like IBM and Software Arts can wield such Machiavellian powers as to impose on the rest of the world standards like EBCDIC (extended-binary-coded-decimal interchange code) and (possibly) DIF without the benefit of good technical review.

Tom Pittman
Itty Bitty Computers
POB 23189
San Jose, CA 95153

I concur with Mr. Pittman's rational approach to the establishment of a standard. However, our industry does not always behave rationally. I take issue with the implication that IBM and Software Arts are necessarily Machiavellian or even monopolistic. To be monopolistic, by definition a company must have exclusive control of the means of producing a product or service. Visicalc may be the best-selling microcomputer program of all time, but that hardly excludes competitors from offering their own types of spreadsheet programs. In the case of IBM, whatever its past record has been in the main-frame market, its behavior in the personal computing market has been remarkably open and nonmonopolistic, if I may use that term . . . CM

Multicolored Players, or The Atari Tutorial Debated

I enjoyed reading Chris Crawford's "The Atari Tutorial, Part 3: Player-Missile Graphics" in the November 1981



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Letters

BYTE (page 312). I believe, however, he has made an error. On page 319 he stated that multicolored players are not possible unless you use display-list interrupts. On the contrary, there is a way to produce multicolored players in BASIC very easily. If you look on page III.7 of the Atari Hardware Manual, you will see that setting the fifth bit of GPRIOR (\$26F) at location 623 decimal will cause a logical OR function of the colors of player 0 with player 1 and player 2 with player 3. The result is a choice of three colors in the overlapped region. The following program demonstrates this effect:

```

10 A=PEEK(106)-8:POKE 54279,A:REM
   SET UP PLAYER - MISSILE GRAPHICS
20 POKE 559,46:POKE 53277,3:REM
   DOUBLE - WIDTH RESOLUTION
30 POKE 704,26:POKE 705,102:REM
   PLAYER 0 & 1 COLORS
40 PMBASE=256*A+512
50 FOR I=0 TO 256:POKE
   PMBASE+I,0:NEXT I
60 FOR I=0 TO 7:READ A:POKE
   PMBASE+48+I,A:NEXT I
70 DATA 255,255,195,195,195,195,255,255
80 FOR I=0 TO 7:READ A:POKE
   PMBASE+176+I,A:NEXT I
90 DATA 60,60,60,60,60,60,60,60
100 L=100:R=148:POKE 53248,L:POKE
    53249,R
110 FOR T=0 TO 1000:NEXT T
120 FOR I=1 TO 24:L=L+1:R=R-1
130 POKE 53248,L:POKE 53249,R:NEXT I
140 FOR T=0 TO 300:NEXT T
150 POKE 623,32:REM SET BIT 5 OF
    GPRIOR
160 GOTO 160
  
```

Lines 50-100 POKE the player images into the player graphics buffer and set their horizontal positions. Lines 110-160 let you see the player images coming together and then the three colors being produced as one player. Remember that to move this three-colored player requires you to POKE the same horizontal position into the horizontal-position registers of both player 0 and player 1.

Peter Hecke
767 Bergen Blvd.
Ridgefield, NJ 07657

Chris Crawford replies:

Thank you for your program; it demonstrates the OR function of GPRIOR bit 5 very well. This technique, however, does not create a multicolored player. Instead, it creates a three-colored object using two players—certainly a useful technique for "getting more for your money" with two players. If you are not otherwise

using all your players, you can create a multicolored object by overlapping several players of different colors. With the technique you describe, you can get seven colors (the normal five plus two "overlap" colors), although you do not have full control over the overlap colors; without this technique, the most you can get is five colors (if you use all four players and the missiles as a fifth player).

The method I referred to in my article modifies the display list to execute an assembly-language display-list interrupt routine to change the color register of a given player while the video image is being drawn. This technique can produce one player that has multiple colors, but it has two disadvantages: first, it can only produce images striped horizontally with different colors; and second, unless you change the display list on the fly, the multicolored player cannot move vertically (display-list interrupts are tied to a certain horizontal line of the video display).

Thanks for sharing your letter and program with other BYTE readers and me.

Wanted: Education In Computerized Business Systems

Students interested in obtaining a university education in the development of business-oriented computer systems should investigate the programs offered by the business schools. Paul Brady in his article on "Bridging the 10-percent Gap" (see the October 1981 BYTE, page 264) identifies the need for this type of training, which combines courses on computers with courses on business organizations and management skills. However, his comments do not indicate that such programs already exist. Rigorous computer science programs provide excellent technical and theoretical training but are not typically designed to produce business-systems analysts and application programmers. For further information on the educational issues involved and a survey of programs offered, see the article by Jay F. Nunamaker Jr., "Educational Programs in Information Systems," *Communications of the ACM*, March 1981, and the in-depth report on "the DPMA Model" in *Computerworld*, September 21, 1981.

Hugh Howson
Professor Invite
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Case postale 8888, Succursale "A"
Montréal P.Q. H3C 3P8 ■

The Atari Tutorial

Part 8: Generating Sound with Software

The sound capabilities of the Atari 400 and 800 computers are influenced by the software technique used.

Bob Fraser
1639 Martin Ave.
Sunnyvale, CA 94087

The sound system in the Atari 400 and 800 microcomputers can be used in two basic ways: static and dynamic. Static sound generation is the simpler of the two. The program sets a few sound generators, turns to other activities for a while, and then turns them off. Dynamic sound generation is more difficult. The computer must continuously update the sound generators during program execution. For example:

```
SOUND 0,120,8,8
```

generates a static sound, while:

```
FOR X=0 TO 255  
  SOUND 0,X,8,8  
NEXT X
```

generates a dynamic sound.

This article appears in slightly different form in De Re Atari, published by Atari Inc., and is reproduced with its express permission.

Static Sound

Although static sound is normally limited to beeps, clicks, and buzzes, there are exceptions. Two examples are the programs given last month as special effects in the sections on high-pass filters and 16-bit sound. Another way to obtain interesting effects is to use interference, as in this example:

```
SOUND 0,255,10,8  
SOUND 1,254,10,8
```

The strange effect is a result of closely phased peaks and valleys. Figure 1 shows two channels independently running sine waves at slightly different frequencies and their sum. The sum curve shows the strange interference pattern created when these two channels are added.

Figure 1 also shows that, at some points in time, the waves are assisting each other; at other points, they oppose each other. Adding the volumes of two waves whose peaks coincide will yield a wave with twice the

strength or volume. Similarly, adding the volumes of two waves while one is at maximum and the other is at minimum will result in a cancellation of both of them. On the graph of the sum curve, we can see this effect. An interesting project would be writing a program to plot interaction patterns of two, three, and four channels; the program would display graphs like that of figure 1. You might discover some unique sounds.

The slighter the difference in frequency between the two channels, the longer the pattern of repetition. To understand this, draw some graphs similar to figure 1 and study the interaction. As an example, try the following BASIC statements:

```
SOUND 0,255,10,8  
SOUND 1,254,10,8  
SOUND 1,253,10,8  
SOUND 1,252,10,8
```

As the difference in frequency grows, the period of repetition decreases.

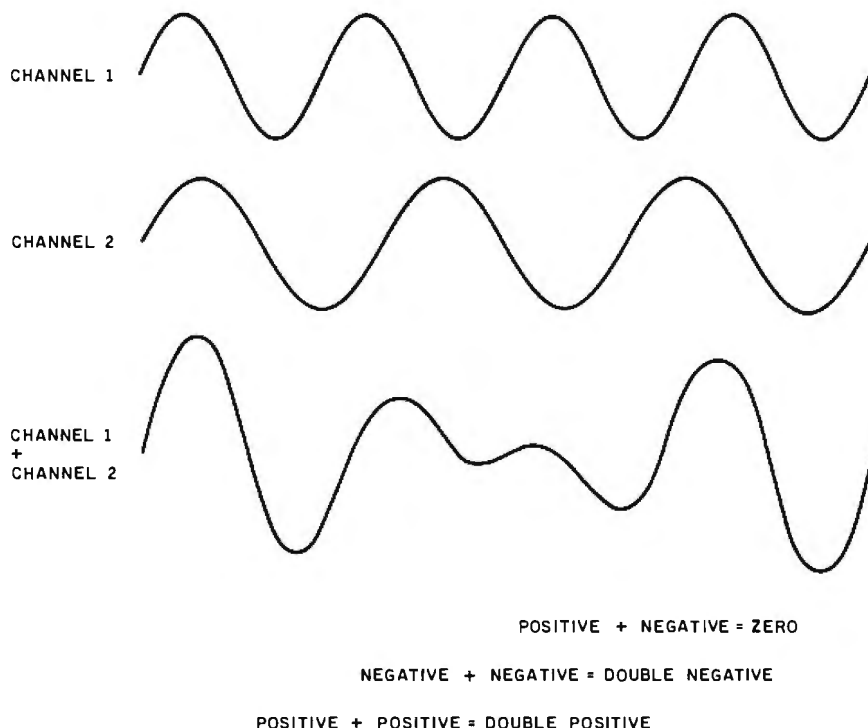


Figure 1: Complex waveform generation from the addition of waveforms.

Listing 1: Using machine language to assist BASIC in generating multiple-note chords on the Atari 400/800. This demonstration program uses a short machine-language program placed in the BASIC string `SIMUL$` (see lines 25 and 9999) to specify the frequency- and control-register values of up to four of the Atari sound generators. It is done quickly enough to make all the generators seem to start simultaneously (BASIC is too slow to do this). Note the use of the string `SIMUL$` to store the machine-language program and the `USR` call in line 50 to execute it.

```

10 SOUND 0,0,0,0:DIM SIMUL$(16)
15 REM read in machine lang. program
20 RESTORE 9999:X=1
25 READ Q: IF Q<>-1 THEN SIMUL$(X)=CHR$(Q):X=X+1:GOTO 25
26 REM read and then play sound data
27 RESTORE 100
30 READ F1,C1,F2,C2,F3,C3,F4,C4
40 IF F1=-1 THEN END
50 X=USR(ADR(SIMUL$),F1,C1,F2,C2,F3,C3,F4,C4)
55 FOR X=0 TO 150:NEXT X
60 GOTO 30
90 REM sound data
100 DATA 182,168,0,0,0,0,0,0
110 DATA 162,168,182,166,0,0,0,0
120 DATA 144,168,162,166,35,166,0,0
130 DATA 128,168,144,166,40,166,35,166
140 DATA 121,168,128,166,45,166,40,166
150 DATA 108,168,121,166,47,166,45,166
160 DATA 96,168,108,166,53,166,47,166
170 DATA 91,168,96,166,60,166,53,166
999 DATA -1,0,0,0,0,0,0,0
9000 REM
9010 REM
9020 REM this data contains the machine lang. program,
9030 REM and is read into SIMUL$
9999 DATA 104,133,203,162,0,104,104,157,0,210,232,228,203,208,246,96,-1

```

Dynamic Sound

More complex sound effects normally require the use of dynamic sound techniques. Three levels of dynamic sound generation are available to the Atari 400/800 programmer: sound in BASIC, 60-hertz (Hz) interrupt sound, and sound in machine code.

BASIC Sound

BASIC is somewhat limited in its handling of sound generation. As you may have noticed, the `SOUND` statement negates any special `AUDCTL` setting. [The audio-control register `AUDCTL` was discussed in last month's installment of "The Atari Tutorial." . . . GW] This problem can be avoided by poking values directly into the sound registers, rather than using the `SOUND` statement.

In addition, the use of BASIC to control sound generation is somewhat limited because of its slowness. If the program is not completely dedicated to sound generation, there is seldom enough processor time to do more than static sound or choppy dynamic sound. The only alternative is to temporarily halt all other processing while generating sound.

Another problem can occur when using the computer to play music on more than one channel. If all four channels are used, the time separation between the first `SOUND` statement and the fourth can be substantial enough to make a noticeable delay between the different channels.

The program in listing 1 solves this problem. `SIMUL$` is a tiny machine-language program that pokes all four sound channels very quickly. A BASIC program using `SIMUL$` can rapidly manipulate all four channels. Any program can call `SIMUL$` by putting the sound-register values inside the `USR` function as in line 50 of the demonstration program. The parameters should be ordered as shown, with the control-register value following the frequency-register value for each channel; this ordering is followed one to four times, once for each sound channel to

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be set. As a speed consideration, as well as a convenience, SIMUL\$ allows you to specify sound for less than four channels (i.e., channels 1 through 3, channels 1 and 2, or just channel 1). Simply omit the unused parameters from the USR function.

SIMUL\$ offers another distinct advantage to the BASIC programmer. The AUDCTL register is reset upon execution of any SOUND statement in BASIC. However, using SIMUL\$, no SOUND statements are executed; thus, the AUDCTL setting is retained.

Another method of sound generation in BASIC is impractical. This method uses the volume-only bit of any of the four audio-control registers. Type in and run the following program:

```
SOUND 0,0,0,0
10 POKE 53761,16:
POKE 53761,31:
GOTO 10
```

This program sets the volume-only bit in channel 1 and modulates the volume from 0 to 15 as fast as BASIC can. Although it uses all the processing time available to BASIC, it produces only a low buzz.

60-Hz Interrupt

This technique is probably the most versatile and practical of all methods available to the Atari computer programmer.

Precisely every 1/60 second the computer hardware automatically generates an interrupt. When this happens, the computer temporarily leaves the main program (the program running on the system—BASIC, Star Raiders, etc.). It then executes an interrupt service routine, a small machine-language routine designed specifically for servicing these interrupts. When the interrupt service routine finishes, it executes a special machine-language instruction that restores the computer to the interrupted program. This all occurs in such a way (if done properly) that the program execution is not affected. In fact, it has no idea that it ever stopped!

The interrupt service routine currently resident on the Atari 400/800

computers maintains timers, translates controller information, and performs other chores requiring regular attention.

Before the interrupt service routine returns to the main program, it can be made to execute any user routine—for example, your sound-generation routine. This is an ideal situation for sound generation since the timing is precisely controlled, and especially since another program can be executing without paying heed to the sound generator. Even more impressive is its versatility. Because it is a machine-language program, the interrupt sound program will lend itself equally well to a main program written in any language—BASIC, assembly language, FORTH, Pascal. In fact, the sound generator will require few, if any, modifications to work with another program or even another language.

A *table-driven* routine offers maximum flexibility and simplicity for such a purpose. Table-driven refers to a type of program that accesses data tables in memory for its information. In the case of the sound generator, the data tables would contain the frequency values and possibly the audio-control-register values. The interrupt service routine would simply read the next entries in the data table and put them into their respective audio registers. Using this method, notes could change as often as 60 times per second, fast enough for most applications.

Once such a program has been written and placed in memory (for example, at location 600 hexadecimal, the beginning of the page of memory reserved for the user), you need to install it as a part of the 60-Hz interrupt service routine. This is accomplished by a method known as *vector stealing*.

Direct control of sound registers with a dedicated machine-language routine opens new doors in sound generation.

Memory locations 224 and 225 hexadecimal contain the address of a small routine called XITVBL (eXIT Vertical BLank interrupt service routine), which is designed to be executed after all 60-Hz interrupt processing is complete, restoring the computer to the main program as previously discussed.

The following procedure shows how vector stealing can be used to install your sound routine:

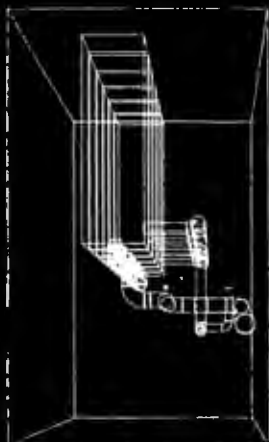
1. Place your program in memory (e.g., 600 hexadecimal).
2. Verify that the last instruction executed is a JMP \$E462 (since location E462 hexadecimal is

the XITVBL routine, this will make the main program continue).

3. Load the X register with the high byte of your routine's address (a 6 in this case).
4. Load the Y register with the low byte of your routine's address (a 0 in this case).
5. Load the accumulator with a 7.
6. Do a JSR \$E45C (to set locations 224 and 225 hexadecimal).

Steps 3 through 6 are required to change the value of the pointer at locations 224 and 225 hexadecimal without error. The routine called is SETVBV (SET Vertical Blank Vectors), which simply puts the address of your routine into locations 224 and 225 hexadecimal. Once installed, the system works as follows when an interrupt occurs:

1. The computer's interrupt routine is executed.
2. The computer jumps to the program whose address is in locations 224 and 225 hexadecimal, which is now your routine.
3. Your routine executes.
4. Your routine then jumps to XITVBL.
5. XITVBL restores the computer's state previous to the interrupt and makes it resume normal operation.



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[An elusive and infuriating "bug" may occur when a 60-Hz interrupt routine involving arithmetic operations (ADC and SBC op codes) is used as part of a BASIC program. The Atari BASIC floating-point routines set the 6502 decimal flag and cause add and subtract operations to be done in binary-coded decimal (BCD) instead of binary. If the 60-Hz interrupt occurs during a BASIC floating-point operation, the interrupt routine will be in decimal—not binary—mode unless you execute a CLD instruction at the beginning of the routine. My thanks to Chris Crawford of Atari for pointing out this bug. . . . GW]

If you do not wish to implement such a program yourself, one is available from the Atari Program Exchange. The package is called IN-SOMNIA (Interrupt Sound Initializer/Alterer). It allows creation and modification of sound data while you listen and is accompanied by an interrupt sound generator that is table-driven and compatible with any language. For more information, contact the Atari Program Exchange, 155 Moffett Park Dr., POB 427, Sunnyvale, CA 94086.

Machine-Code Sound Generation

Direct control of sound registers with a dedicated machine-language routine opens new doors in sound generation. The technique is as follows: write a program similar to the 60-Hz interrupt routine in that it

is table-driven. However, the only routine now being executed by the Atari is dedicated to sound generation. By expending much more processor time on sound generation, you can produce higher-quality sounds. Consider, for example, the output of a typical 60-Hz interrupt music routine; its output will look something like figure 2a.

The volume-only bit offers a tremendous capacity for accurate sound reproduction.

Since much more processing time is available with a dedicated machine-language routine, you can change the frequency at very high speed during the note's playing time. For example, suppose you discover that whenever any piano key is struck it produces the characteristic sequence of frequencies shown in figure 2b.

The graph in figure 2b is called the *piano envelope*. To simulate a piano, the idea is to apply the piano envelope very quickly to the "plain-vanilla" square-wave beep. The note is thus slightly modified during its playing time. For example, a piano simulation of the three notes in figure 2a would be modified to look like figure 2c. This is essentially the same sound produced by the standard music routine of figure 2a, only the

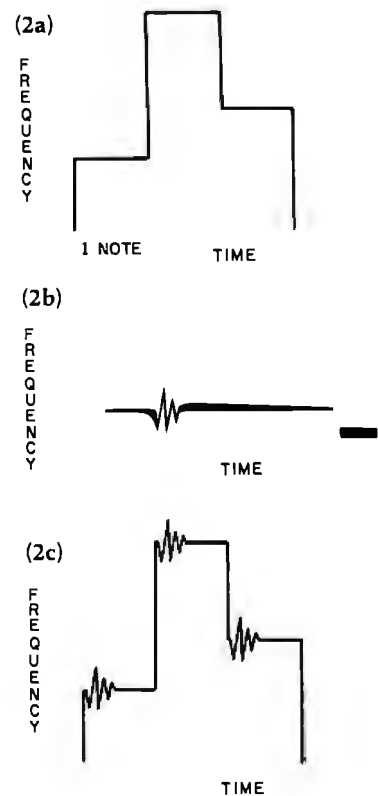


Figure 2: Complex waveform generation under computer control. Figure 2a shows a frequency-versus-time plot of three simple notes generated by one of the Atari sound generators. If the complete resources of the computer are used to modulate the frequency (or other parameters) of the notes while they are being played, the computer can produce highly complex sounds. For example, if we find that a frequency envelope such as figure 2b simulates the sound of a piano, the envelope can be superimposed on the generated notes of figure 2a to give a modified set of notes that has a graph like that of figure 2c.

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Listing 2: *A machine-language program that uses the waveform mode of the Atari 400/800 to generate tones with a sine wave amplitude envelope (tones normally produced by the Atari have a square-wave amplitude).*

0100 ;		0480	LDA VTAB,X
0110 ; VONLY	Bob Fraser 7-23-81	0490 L0	LDY TEMPO
0120 ;		0500	STA AUDC1
0130 ;		0510 L1	DEY
0140 ; volume-only AUDC1-4 bit test routine		0520	BNE L1
0150 ;		0530 ;	
0160 ;		0540 ;	dec most significant counter
0170 ;		0550	DEC MSC
0180 ;		0560	BNE L0
0190 AUDCTL=\$D208		0570 ;	
0200 AUDF1=\$D200		0580 ;	
0210 AUDC1=\$D201		0590 ;	new note
0220 SKCTL=\$D20F		0600 ;	
0230 ;		0610	INX
0240 ;		0620	CPX NC
0250	*=\$B0	0630	BNE LOO
0260 TEMPO	.BYTE 1	0640 ;	
0270 MSC	.BYTE 0	0650 ;	wrap note pointer
0280 ;		0660	LDX #0
0290 ;		0670	BEQ LOO
0300 ;		0680 ;	
0310	*=\$4000	0690 ;	
0320	LDA #0	0700 NC	.BYTE 28 ; note count
0330	STA AUDCTL	0710 ;	
0340	LDA #3	0720 ;	table of volumes to be played in succession
0350	STA SKCTL	0730 VTAB	
0360	LDX #0	0740	.BYTE 24,25,26,27,28,29,30,31
0370 ;		0750	.BYTE 30,29,28,27,26,25,24
0380	LDA #0	0760	.BYTE 23,22,21,20,19,18,17
0390	STA \$D40E ; disable vertical blank interrupt	0770	.BYTE 18,19,20,21,22,23
0400	STA \$D20E ; disable nonmaskable interrupts	0780 ;	
0410	STA \$D400 ; disable screen DMA	0790 ;	this table contains the duration of each entry above
0420 ;			
0430 ;		0800 DTAB	
0440 ;		0810	.BYTE 1,1,1,2,2,2,3,6
0450 LOO	LDA DTAB,X	0820	.BYTE 3,2,2,2,1,1,1
0460	STA MSC	0830	.BYTE 1,1,2,2,2,3,6
0470 ;		0840	.BYTE 3,2,2,2,1,1

notes now have a piano tone and they sound much prettier than just unmodulated beeps. Unfortunately, all other processing had to be sacrificed to get that piano tone. The sound channel is no longer updated only once every note; it is now done perhaps 100 times within the note's duration.

Volume-Only Sound

As indicated earlier, the AUDCn volume-only bits aren't of much use in BASIC. This is due entirely to the fact that BASIC is too slow to effectively use them. However, this is not the case with machine language.

As mentioned last month, the volume-only bit of the AUDCn registers offers a tremendous capacity for accurate sound reproduction.

True waveform generation (within the time and volume resolution limits of the computer) is made possible with this bit. Instead of just putting a piano flavor into the music, you can now make it closely replicate a piano sound. Unfortunately, it can never precisely duplicate an instrument. Four bits (16 values) is not enough volume resolution for true high-quality work. Nevertheless, the technique does generate surprisingly good sounds. The program in listing 2 demonstrates the use of one of the volume-only bits. If you have an assembler, type it in and try it. Surprisingly, speed is not really a problem here. The wave has almost sixty steps, and the program can still be made to play the wave at up to 10 kilohertz.

Remove lines 390 through 410 and try the program once more. It will sound quite broken up. The cause is the 60-Hz interrupt discussed in the previous section. You can actually hear the interrupts taking place since all sound stops during that time.

Line 410 disables screen DMA (direct memory access). By disabling screen DMA, the ANTIC chip within the Atari 400/800 no longer "steals" time from the 6502 processor to get data from screen memory in time to display it on the video display. This is why the screen goes to a solid background color when the program is executed. Disabling screen DMA serves two purposes: to speed up the 6502 processor and to make the timing consistent, since screen DMA steals cycles at odd intervals.

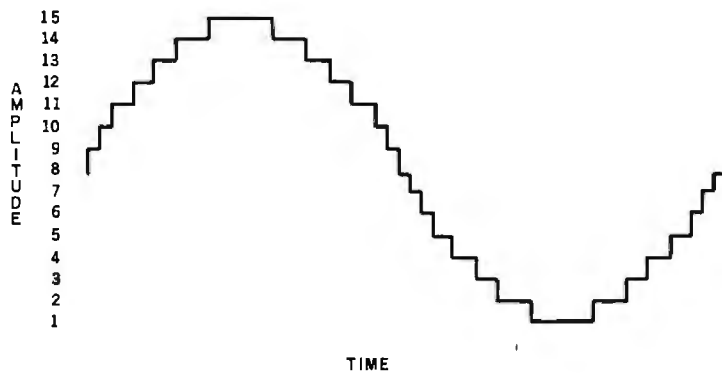


Figure 3: An amplitude-versus-time graph of the sine wave sound produced by listing 2.

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In this demonstration program, the sound created is a close approximation to a sine wave. A graph of the waveform is given in figure 3.

The Role of Sound in Programs

This article and last month's installment of "The Atari Tutorial" have discussed the technical aspects of sound generation with the Atari 400 and 800 computers. However, the programmer must also understand the broader role of sound in the complete software package.

Moviemakers have long understood the importance of mood-setting background music. The recent *Star Wars* movies by George Lucas are excellent examples. When Darth Vader enters the room, you immediately fear and hate him because of the menacing background rhythms accompanying his entry. You know to gleefully applaud when Luke Skywalker saves Princess Leia because gallant music plays in the background. Likewise, horror films can frighten you merely by playing eerie music, even though the action may be completely ordinary.

Tatio America's Space Invaders program for the Atari 400/800 issues a personal threat to the player with its echoing stomp. As the tempo increases, knuckles whiten and teeth grind. When you fire a photon torpedo in Atari's Star Raiders game, the computer gives you a "launch" sound that decreases in frequency as the torpedo speeds away from you. The effective use of sound can increase your involvement with a game or other program.

Impressionistic sounds affect our subconscious and our state of mind. This may be due to the fact that sounds, if present, are continuously entering our mind whether or not we are actively listening. Visual inputs, on the other hand, require the user's attention. If we are distracted from the TV set, we cease to concentrate on the picture and the image leaves our mind. Sound therefore offers the programmer a direct path to the users' minds—bypassing their thought processes and zeroing in on their emotions. ■

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Circle 565 on inquiry card.

Two Atari Games

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Both games are available on cassette for \$15.95 each. For details, contact Concom Enterprises, 2626 West Touhy, Chicago, IL 60645.

CP/M-Compatible Utility

Lifeboat Associates' Zap80 is a menu-driven 5¼- and 8-inch disk access utility for SB-80 and other CP/M-80-compatible

8080/Z80 operating systems. Zap80 automatically allows direct file viewing and patching by actual memory address. Zap80 is designed for experienced users and includes extensive file-utility servicing to access and patch file sectors, compare files, and so forth. For details, contact Lifeboat Associates, 1651 Third Ave., New York, NY 10028, (212) 860-0300.

Circle 566 on inquiry card.

New Hashing Method Speeds Database Manager

Micro Architect's IDM-X is a general-purpose interactive database manager for the TRS-80 Model II. The IDM-X features a built-in sort/merge package and a fast key-access method that uses a new hashing algorithm. IDM-X supports string, double-precision floating decimal, and integer variables. Other features include formatted numeric fields, using BASIC formats, and an extensive report writer.

The basic components of IDM-X are a database initialization program, a database manipulation program, the report writer, and a report generator. A dual-disk TRS-80 Model II with 64K bytes of memory is required. IDM-X costs \$399; the user manual is available separately for \$25. For additional information, request a product catalog from Micro Architect Inc., 96 Dothan St., Arlington, MA 02174, (617) 643-4713.

Circle 567 on inquiry card.

CP/M-86 for the IBM Personal Computer

Compuvision's CP/M-86 (CP/M is a registered trademark of Digital Research) for the IBM Personal Computer includes an interactive line editor that permits cursor movement to the previous line and horizontal scrolling to a width of 162 characters, and emulation of terminals such as Televideo, the IBM 3101, and the Zenith Z-19. Other features are an increase in disk capacity from the 160K bytes supported by MS-DOS to 193K bytes; the ability to read and write many soft-sectored disk formats, including the Xerox 820's format; support for both serial and parallel printers; a disk formatter; a disk-copy program that makes a fast, "image" copy; the ability to set transmission rates for serial ports; and support of Tecmar's hard-disk drive and other peripherals.

For further information, contact Compuvision, Suite 200, 1955 Pauline Blvd., Ann Arbor, MI 48103, (313) 996-1299.

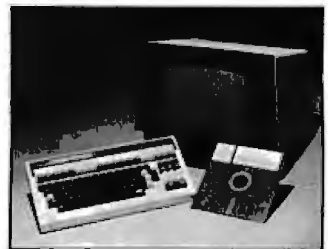
Circle 568 on inquiry card.

Slide Rule Simulator

The Slide-Simulator transforms your TRS-80 Color Computer into a Mannheim-type slide rule. Using high-resolution graphics and controlled by the game paddles, the program simulates full log-log functions. A special expanded viewing option allows easy reading of the

scales. The program is available on a 5¼-inch floppy disk. For price information and a catalog of other innovative software, contact Abstract Mathematical Concepts Inc., 70 Main St., Putterboro, NH 03458.

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Keyboard Eases Word Processing

A computer designed primarily to handle small-business applications is now available with a keyboard dedicated to word processing. The new keyboard is based on a Visual 200 computer terminal with electronic and mechanical adaptations for Micropro's Wordstar word-processing system. The keyboard allows the user to strike a single color-coded key for center line, release or set margins, clearing or setting tabs, underscore, or any one of 24 other commonly used word-processing commands and cursor movements.

The keyboard option is available on new Prodigy installations or as a field upgrade. For more details, contact Prodigy Systems Inc., 497 Lincoln Highway, Iselin, NJ 08830, (201) 283-2000.

Circle 569 on inquiry card.

The Atari Tutorial

Part 9: Even More Colors!

Television artifacts and the new GTIA chip allow even more colors to be displayed on Atari computers.

Kathleen Pitta and Lane Winner
Atari Inc.
30 East Plumeria
POB 50047
San Jose, CA 95134

The Atari 400 and 800 home computers allow the programmer to display many colors with their powerful color-register systems. Even more colors can be obtained with television artifacts and the new GTIA chip.

Television Artifacts

A *television artifact* is a pixel on the screen that displays a different color on the screen than the one assigned to it. This happens because the television display signal can become confused. The astute programmer can turn this bug into a feature. The ANTIC modes with which this can be accomplished are 2, 3, and 15. [Remember that the ANTIC mode numbers are not the same as the BASIC "GRAPHICS n" numbers;

ANTIC mode 15 is not a mistake. . . . G. W.] Each of these modes has a pixel resolution of one-half color clock by one scan line; each has one color and two luminances. With the use of artifacts, pixels of four different colors can be displayed on the screen in each of these modes.

A simple example of artifacts when using the Atari home computer is shown by the following lines of BASIC:

```
GRAPHICS 8
COLOR 1
POKE 710,0
PLOT 60,60
PLOT 63,60
```

These statements plot two points on a black background, each with a different color. To understand why these colors are different, you must first understand how the display information for the television display is contained in a modulated television signal.

The two major components of this signal are the *luminance* (or bright-

ness) and the *color* (or tint). The luminance information is the primary signal, containing not only the brightness data but also the timing and synchronization signals. The color signal contains the color information and is combined or modulated onto the luminance waveform.

The luminance of a pixel on the screen is directly dependent on the amplitude of the luminance signal at that point. The higher the amplitude of the signal, the brighter the pixel. The color information, however, is a *phase-shifted signal*, which is a constantly oscillating waveform that has been delayed by some amount of time relative to a reference signal. This time delay is translated into the color.

The color signal oscillates at a constant rate of about 3.579 megahertz (MHz). The Atari home computer offers a high-resolution graphics mode (GRAPHICS 8) that displays 320 pixels across one horizontal scan line. The hardware does this by varying the amplitude of the luminance signal at 7.16 MHz, which is twice the color frequency. Since the color and lumi-

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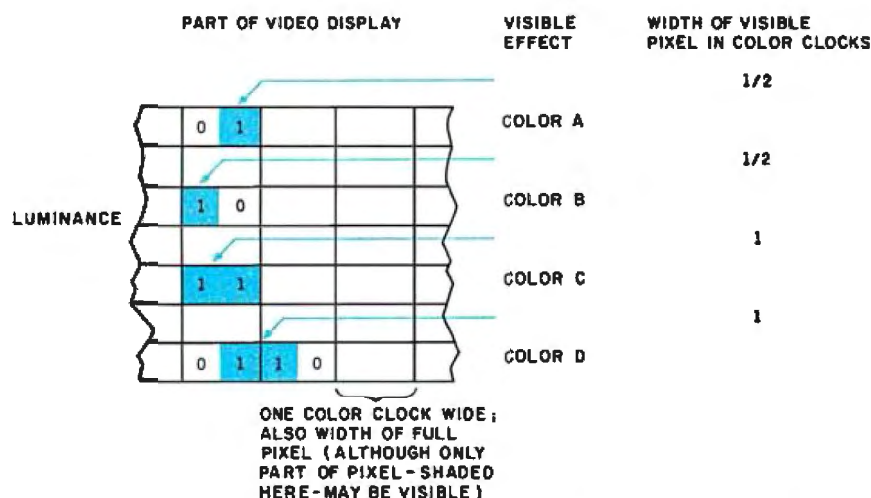


Figure 1: In this example of artifact color pixels, the visible portion of a pixel is one-half color clock wide, and its position within a color clock influences the color produced. See figure 2 and listing 1 for another example of artifact color pixels.

nance signals are theoretically independent, you should be able to assign any background color to be displayed and then vary the luminance on a pixel-by-pixel basis. This is, in fact, the way mode 8 works, the background color coming from playfield register 2 and the luminances coming from both playfield registers 1 and 2.

However, a problem does arise. In practice, the color and luminance signals are not independent. They are part of a modulated signal that must be demodulated by the television receiver before they can be used. Since the luminance is the primary signal, whenever it changes, it also has a drastic effect on the color phase shift. For one or more color clocks of constant luminance this is no problem, since the color phase shift will be unchanged in this area. However, if the luminance changes on a half color-clock boundary, it will also produce a color shift at that point. Moreover, the color obtained cannot be controlled from the transmitting end of the signal (the computer). The artifact color obtained is defined by the settings of the television receiver.

(A color clock is a *physical* unit of horizontal distance on the video display—160 color clocks per line of video display. A pixel is a *logical* unit of video display with a size that varies with the graphics mode in use.

Depending on the graphics mode, a pixel may be one-half, one, two, or more color clocks wide.)

Since the luminance can change on half color-clock boundaries, two artifact colors can be generated, one for each side of the color clock. These two artifact color pixels can be combined to form two additional types of

The artifact colors are definitely distinct from each other, and programs can be written that utilize them.

full color-clock pixels. This is illustrated in figure 1.

Each of these pixels requires one color clock of screen space (although the visible part of the pixel is one-half color clock). Hence, the resulting display has an effective horizontal resolution of 160 pixels.

The colors A through D are different for each television set, usually because the tint-knob settings vary. Thus, the actual colors obtained cannot be controlled by the programmer. They are definitely distinct from each other, and programs can be written that utilize these artifact colors.

To illustrate a simple application of artifacting, refer to the sample pro-

gram in listing 1. This program draws lines in each of the four artifact colors (see figure 2) and then fills in areas using three of the colors. (Displaying many pixels of either type C or D next to each other results in the same thing: a line of constant luminance with background color.) The POKE 87,7 command causes the operating system to treat this mode as mode 7 instead of mode 8 and to use 2-bit masks when setting bits in the display memory; this tricks the Atari into creating pixels one-half color clock wide. To generate color A, use the COLOR 1 command. The COLOR 2 command produces color B; the COLOR 3 command produces color C. Color D is generated by displaying COLOR 1 to the left of COLOR 2.

The GTIA Chip

The new GTIA display chip for the Atari home computer will someday replace the CTIA chip currently in use. The GTIA is nothing more than a CTIA with a few extra features. It provides three additional modes of interpretation of information coming from the ANTIC chip. ANTIC does not require a new display mode to use the special GTIA modes; instead, it uses the high-resolution mode F hexadecimal. GTIA is completely upward-compatible with the CTIA. A brief summary of the CTIA's features follows so that the differences between the two can be explained.

The CTIA is designed to display data on a television screen. It displays the playfield, players, and missiles. CTIA uses the data from ANTIC to display hue and luminance as defined by the four color registers. The GTIA expands this to use all nine color registers or 16 hues with one luminance or 16 luminances of one hue.

The three graphics modes of GTIA are simply three new interpretations of ANTIC mode F hexadecimal, a high-resolution mode. All three modes affect the playfield only. Players and missiles can still be added to introduce new hues or luminances, or to use the same colors and luminances in more than one way. All displays of hues and luminances can still be changed on-the-fly with

Listing 1: An Atari BASIC program to display artifact colors. See the text and figures 1 and 2 for details.

```

10 GRAPHICS 8:POKE 87,7:POKE 710,0:POKE 709,14
20 COLOR 1:PLOT 10,5:DRAWTO 10,70
30 PLOT 40,5:DRAWTO 40,70
40 COLOR 2:PLOT 20,5:DRAWTO 20,70
50 PLOT 41,5:DRAWTO 41,70
60 COLOR 3:PLOT 30,5:DRAWTO 30,70
70 FOR X=1 TO 3:COLOR X:POKE 765,X
80 PLOT X*25+60,5:DRAWTO X*25+60,70
90 DRAWTO X*25+40,70:POSITION X*25+40,5
100 X10 18,16,12,0,"S:"
110 NEXT X

```

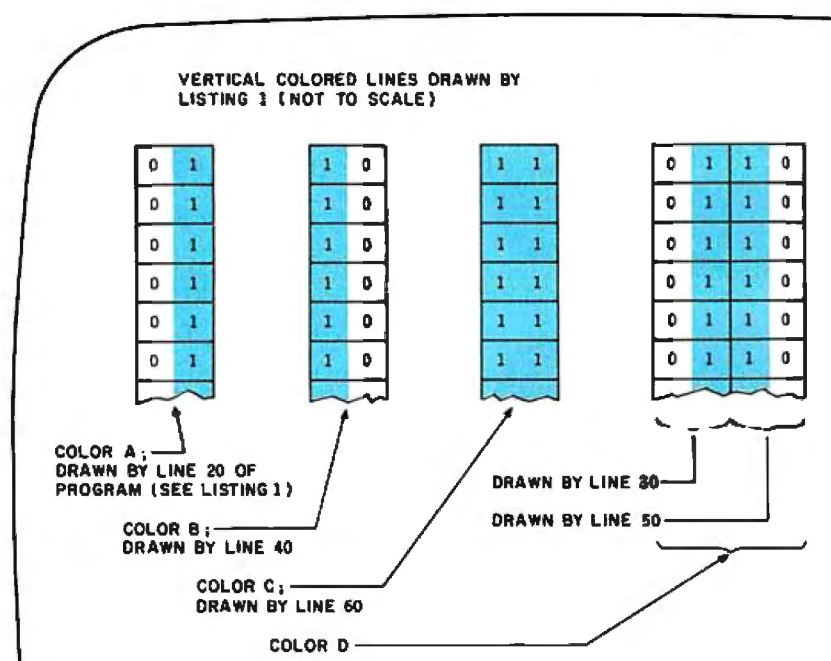


Figure 2: An enlarged view (not to scale) of the upper left-hand corner of the video display produced by listing 1. This figure helps to explain how listing 2 produces four colored vertical lines from three different types of pixels.

PRIOR						
D7	D6					
OPTION						
0	0	NO GTIA MODES {CTIA OPERATION}				(MODES 0 THROUGH 8)
0	1	1 HUE, 16 LUMINANCES				(MODE 9)
1	0	9 HUES/LUMINANCES				(MODE 10)
1	1	16 HUES, 1 LUMINANCE				(MODE 11)

Figure 3: Activation of graphics modes 9, 10, and 11. The two most significant bits of the hardware register PRIOR control the selection of these modes. For information on the use of the low 6 bits of the PRIOR register, see page 338 of the November 1981 BYTE.

display-list interrupts. The GTIA uses 4 bits of data from ANTIC for each pixel, called the pixel data. Each pixel is two color clocks wide and one scan line high. Thus, the pixels are roughly four times wider than their height. The display has a resolution of 80 horizontal pixels by 192 vertical pixels. Each line requires 320 bits (40 bytes) of memory, the same number used in ANTIC mode F hexadecimal. Therefore, for a program to run the GTIA modes, it must have at least 8K bytes of free RAM (random-access read/write memory) for the display.

The GTIA modes are selected by the priority register PRIOR, which is located at address D01B hexadecimal and shadowed at address 26F hexadecimal. [The contents of shadow registers are copied into their associated registers every 1/60 second. Thus, you will usually alter shadow registers, not the hardware registers themselves. . . . G. W.] Bits D6 and D7 are the controlling bits. The effects of these bits are presented in figure 3.

Setting up the new GTIA modes is as simple as setting up the present modes supported by CTIA. To implement the modes from BASIC, simply use a GRAPHICS 9, GRAPHICS 10, or GRAPHICS 11 command. In assembly-language programs, selecting one of these modes is done by opening the screen device through CIO. If you are building your own display list, PRIOR must be set to select the correct mode.

Mode 9

Mode 9 produces up to 16 different luminances of the same hue. ANTIC provides the pixel data that selects one of 16 different luminances. The background color register provides the hue. In BASIC, this is done by using the SETCOLOR command to set the hue value in the upper nybble (4 bits) of the background color register and to set the luminance value in the lower nybble to all zeros. The format of the command is

```
SETCOLOR 4,HUEVALUE,0
```

where 4 specifies the background

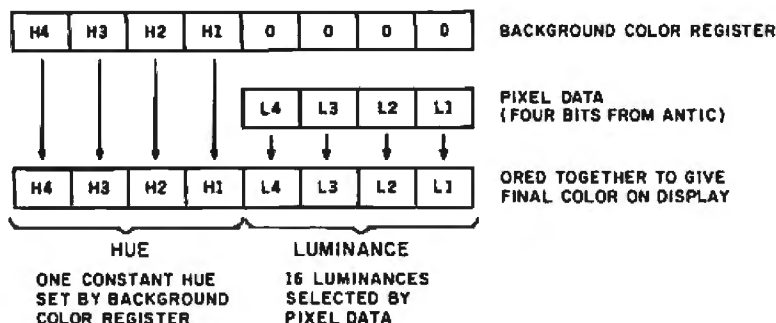


Figure 4: Interpretation of a byte of memory as a color pixel in graphics mode 9. Mode 9 gives one hue at 16 possible luminances.

Listing 2: An Atari BASIC program that illustrates BASIC graphics mode 9 by drawing 16 vertical lines of varying luminances (same hue).

```

10 GRAPHICS 9
20 SETCOLOR 4,12,0:REM initialize the background color to green
30 FOR I=0 TO 15:REM draw in different luminances
40 COLOR I
50 PLOT 2,I,10
60 DRAWTO 2,I,80
70 NEXT I
80 GOTO 80:REM hang up in a loop

```

color register, HUEVALUE sets the hue and can be anything from 0 to 15, and 0 sets the luminance part of the register to zero. The background luminance *must* be zero because the pixel data from ANTIC will be logically ORed with the lower nybble of the background color register to get the luminance that appears on the screen (see figure 4). Use the COLOR command to select luminances for drawing on the screen; its argument (ranging from 0 to 15) specifies the luminance. A sample BASIC program to use mode 9 is shown in listing 2.

Assembly-language programs should write the hue directly into the upper 4 bits of the shadow location for the background color register at location 2C8 hexadecimal. If you use CIO calls to draw to the screen, store the pixel data into ATACHR located at 2FB hexadecimal. This selects the luminance with values from 0 to F hexadecimal. If you are maintaining your own display data, the pixel data goes directly into the left or right half of the display RAM byte.

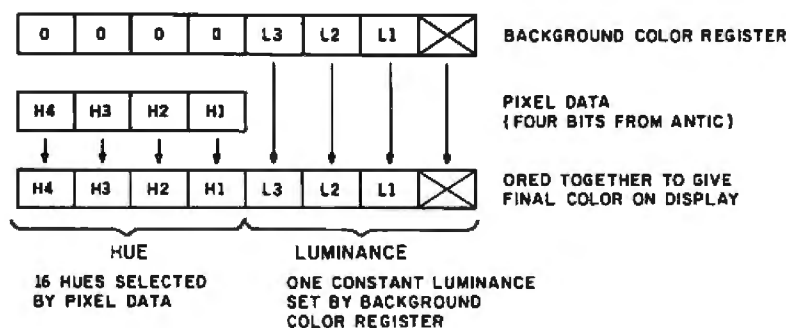


Figure 5: Interpretation of a byte of memory as a color pixel in graphics mode 11. Mode 11 gives up to 9 hues at the same luminance level.

Mode 11

Mode 11 is similar to mode 9 except that it provides 16 different hues all with the same luminance. ANTIC provides the pixel data to select one of 16 different hues (see figure 5). In BASIC, use the SETCOLOR command to declare the single luminance value in the lower nybble of the background color register. Set the upper nybble of the background color register (the hue nybble) to zero. The format of the command is

SETCOLOR 4,0,LUMVALUE

where 4 specifies the background color register, 0 sets the upper nybble to zero, and LUMVALUE sets the value of the luminance and can range from 0 to 15. As with the other graphics modes (except mode 9), the lowest bit of the luminance is not used. The effective result is that only even numbers result in distinct luminances, which gives eight possible luminances in this mode. Use the COLOR command in this mode to select the various hues by selecting values from

Listing 3: An Atari BASIC program that illustrates BASIC graphics mode 11 by drawing 16 vertical lines of varying hues (same luminance).

```

10 GRAPHICS 11
20 SETCOLOR 4,0,12:REM initialize the background color
30 FOR I=0 TO 15
40 COLOR I:REM select different colors
50 PLOT 2,I,10
60 DRAWTO 2,I,80:REM draw bars in different colors
70 NEXT I
80 GOTO 80

```

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COLOR Statement Value	Address of Color Register Used (Hexadecimal)	Address of Operating-System Shadow Location (Hexadecimal)
0	D012	2C0
1	D013	2C1
2	D014	2C2
3	D015	2C3
4	D016	2C4
5	D017	2C5
6	D018	2C6
7	D019	2C7
8	D01A	2C8

Table 1: Addresses of color registers and their shadow locations affected by the COLOR statement in BASIC.

Listing 4: An Atari BASIC program that illustrates BASIC graphics mode 10 by drawing 16 vertical lines of varying hues and luminances.

```
10 GRAPHICS 10
20 FOR I=0 TO 8
30 POKE 704+I,255-RND(I):REM set random colors
40 COLOR I
50 PLOT 2-I,10
60 DRAWTO 2-I,80:REM draw in bars of color
70 NEXT I
80 GOTO 80:REM hang up in a loop
```

0 to 15 for its argument. The pixel data from ANTIC will be logically ORed with the upper nybble of the background color register to set the hue part of the value that ultimately generates the color on the screen. A sample BASIC program using mode 11 is presented in listing 3.

In assembly language, use the operating-system shadow location for the background color register (at 2C8 hexadecimal) to set the luminance in the lower 4 bits with values from 0 to F hexadecimal. If you use CIO calls to write to the screen, store the pixel data to be written into ATACHR located at 2FB hexadecimal. This selects the hue with values from 0 to F hexadecimal. If you are maintaining your own display data, the pixel data goes directly into the left or right half of the display RAM byte.

Mode 10

Mode 10 allows all nine color registers to be used in the playfield at one time. Each color register to be used must be set to some combination of hue and luminance. The pixel data from ANTIC is used in this mode to select one of the color registers for

display. In BASIC, the SETCOLOR command can be used as described in the *Atari 400/800 BASIC Reference Manual* to set the colors in the background and the four playfield registers. These can also be set by using the POKE instruction to addresses 708 through 712 decimal where the four playfield registers and the background register are located. The POKE instruction must be used to set the four player/missile color registers at locations 704 through 707 decimal. The COLOR command is used to select the color register desired, as shown in table 1. The only meaningful values for its argument are 0 to 8. A problem arises with this mode. ANTIC supplies 4 bits of data per pixel, as it does with modes 9 and 11. This allows for the selection of 16 color registers. However, only nine color registers exist in the hardware. An illegal data value between 9 and 15 will select one of the lower-value color registers. A sample BASIC program using mode 10 is given in listing 4.

In assembly language, store the pixel data into ATACHR (location 2FB hexadecimal) or directly into the

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display RAM byte, as in modes 9 and 11. In this mode, the pixel data can range from 0 to 8 and selects one of the nine color registers.

Advantages and Disadvantages

An important question arises in conjunction with GTIA concerning compatibility. GTIA is fully upward-compatible with the CTIA, and all software that runs on a CTIA system will run the same way on a system with GTIA. This means you still have full use of players and missiles, collision detection, and display-list interrupts. The GTIA graphics modes are supported by the operating system, and all graphics commands and utilities that run in the CTIA modes can be used in GTIA modes.

The GTIA allows the programmer to display more colors on the screen with less work. Sixteen colors can be shown on one horizontal line. This is better than what can be done with horizontal kernels (see "The Atari Tutorial, Part 4: Display-List Interrupts," December 1981 BYTE, page 181) that can give a maximum of 12 colors per horizontal line. Much finer contour and depth can be represented using the shading available in mode 9. This means three-dimensional graphics can be realistically displayed.

Some disadvantages are associated with use of the GTIA chip. GTIA modes are map modes; text cannot be displayed in these modes without recourse to custom display lists. The GTIA pixel is a long, skinny horizontal rectangle (4:1 ratio, width to height) that does not represent curved lines well. Because each pixel uses 4 bits of information, GTIA requires nearly 8K bytes of free RAM to operate. Although it is upward-compatible, it is not downward-compatible. Thus, programs that use GTIA modes will not produce correct displays on computers that have CTIAs. There is no way currently for a program to determine whether or not a GTIA is present in a system. Finally, color artifacts produced by a GTIA system will not be identical to the color artifacts produced on the same television with a CTIA system. ■

Software Received

Apple

AgDisk Financial Management Series One, an agricultural financial-management package in Pascal for the Apple II. Floppy disk, \$140. Harris Technical Systems, 624 Peach St., POB 80837, Lincoln, NE 68501.

Alkemstone, an adventure-type game for the Apple II. Floppy disk, \$39.95. Level-10, Suite 507, 7475 Dakin St., Denver, CO 80221.

Apple-Aids, a disk-utility package for the Apple II. Floppy disk, \$49.95. Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360.

Beer Run, an arcade-type game for the Apple II. Floppy disk, \$29.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Enhanced Graphics Software for the IDS 460G/560G, a graphics utility for the Apple II. Floppy disk, \$44.95. Computer Station Inc., 11610 Page Service Dr., St. Louis, MO 63141.

Graphic Writer, utility to combine graphics with Applewriter text for the Apple II. Floppy disk, \$34.95. Computer Station Inc. (see address above).

Hadron, an arcade-type game for the Apple II. Floppy disk, \$34.95. Sirius Software Inc. (see address above).

Hi-Res Computer Golf, a computerized golf game for the Apple II. Floppy disk, \$29.95. Avant-Garde Creations, POB 30160, Eugene, OR 97403.

The Liberator, a programming utility and library of subroutines for the Apple II. Floppy disk, \$29.95. Pear Software, 407 Terrace, Ashland, OR 97520.

Pascal Hi-Res Graphics Dump Routine for the IDS 460G, a graphics utility in Pascal for the Apple II.

Floppy disk, \$44.95. Computer Station Inc. (see address above).

Snake Byte, an arcade-type game for the Apple II. Floppy disk \$29.95. Sirius Software Inc. (see address above).

Sneakers, an arcade-type game for the Apple II. Floppy disk, \$29.95. Sirius Software Inc. (see address above).

Ultra Hi-Res Graphics, utility for use with the IDS 460G/560G printers with the Apple II. Floppy disk, \$49.95. Computer Station Inc. (see address above).

Atari

Atari Word Processor, a word-processing system for the Atari 800. Floppy disk, \$149.95. Atari Inc., Computer Division, POB 427, Sunnyvale, CA 94086.

The Duplicating Machine, a program-duplication utility for the Atari 400 and 800. Floppy disk, \$19.95. Midwest Software, 2707A Ridge Court, Lawrence, KS 66044.

CP/M

CP/M Adventures 1-12, a series of Scott Adams's adventures for CP/M (Z80). 8-inch floppy disk, \$129.95. Adventure International, 507 East St., POB 3435, Longwood, FL 32750.

Ficomp CP/M 2.2. Utilities, a set of utility programs for CP/M (Z80). 8-inch floppy disk, \$24.95. Ficomp Inc., 3017 Talking Rock Dr., Fairfax, VA 22031.

Copy86, a utility program for copying Z80 CP/M files to and from 86-DOS. 8-inch floppy disk, \$120. GIOS Enterprises, 9784 Woodholow Way, Sacramento, CA 95827.

PET

Concentration, Memory, Cosmic Collision, Hangman, and Torpedo Command, games for the PET 2001.

Cassette, \$5.99 each. Royal Software, 149-45 83rd St., Howard Beach, NY 11414.

PET/CBM Cross-Reference Program, a cross-reference utility program for the PET/CBM. Floppy disk, \$29.95. Oppenheimer Software, 79th Street Boat Basin #39, New York, NY 10024.

Texas Instruments

Adventureland, an adventure-type game for the TI-99/4. Floppy disk, \$29.95. Texas Instruments Inc., 13500 North Central Expressway, POB 225012, Dallas, TX 75265.

Car Wars, an arcade-type game for the TI-99/4. Command Module (i.e., ROM cartridge), \$39.95. Texas Instruments Inc. (see address above).

The Count, an adventure-type game for the TI-99/4.

Floppy disk, \$29.95. Texas Instruments Inc. (see address above).

Ghost Town, an adventure-type game for the TI-99/4. Floppy disk, \$29.95. Texas Instruments Inc. (see address above).

Pirate Adventure, an adventure-type game for the TI-99/4. Floppy disk and Command Module (i.e., ROM cartridge), \$29.95. Texas Instruments Inc. (see address above).

Pyramid of Doom, an adventure-type game for the TI-99/4. Floppy disk, \$29.95. Texas Instruments Inc. (see address above).

TRS-80

Bisplan, a business-modeling program for the TRS-80 Models I and III. Cassette, \$20. Mariah Com-

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Imagine yourself as a student pilot in a light plane coming in for a landing. As you make your approach, you see the landing strip through the propeller's arc. The computer informs you of the distance to the field. You glance at the instruments, and then back at the field. The sound of the engine changes as you glide in for the touchdown. You then request a view of the landing as seen from the field. The computer responds to your request, and asks if you want to repeat the landing. Are you flying a super complicated flight simulator? No, you're interacting with a videodisc player interfaced to a personal computer.

This experimental flight-training program developed by the Nebraska Videodisc Design/Production Group uses a realistic visual database from the videodisc player controlled by a TRS-80 Model III, which also provides the text "overlay." The overlay is used to plot running distances between the airstrip and the aircraft; provide additional instrumentation data; and point out tutorial

information for the pilot trainee, all "keyed" over the videodisc-player picture (see photo 1).

[Editor's Note: Like all new developments in microcomputers, videodisc interfacing comes complete with its own set of technical terms and jargon. The author has thoughtfully provided a glossary, located at the end of this article, to help decipher these terms. . . .S. J. W.]

Another example of computer-controlled interactive videodiscs is Think It Through, a problem-solving

About the Author

Rod Daynes is the director of the Videodisc Design/Production Group. Starting in 1978, the Office of Science and Technology at the Corporation for Public Broadcasting funded station KUON-TV at the University of Nebraska to investigate the potential of videodisc technology, with special emphasis on interactive and educational applications. Initial funding was used to investigate interactive videodisc applications for the hearing impaired. This resulted in the first two videodiscs ever made with closed captions, providing teletext-like applications for hearing-impaired children. The Nebraska Videodisc Design/Production Group has since developed more than 30 interactive videodiscs covering a variety of subjects.

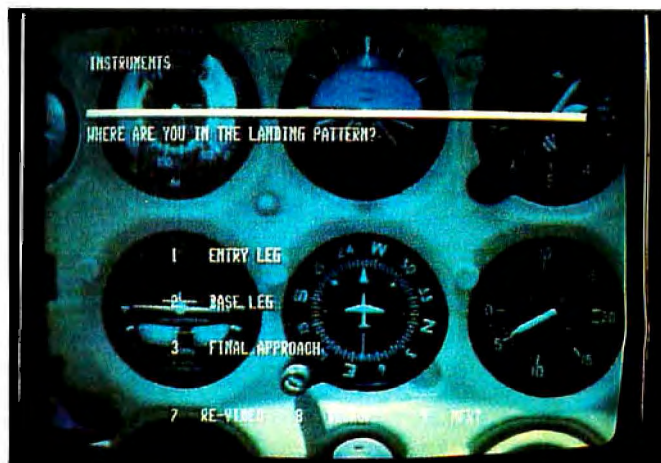


Photo 1: An "instrument tutorial" section of a low-cost flight-training system using the "overlay" interface, a TRS-80 Model III, and an optical videodisc player. The text, generated by the computer, is keyed directly over NTSC video (the flight instruments).

exercise/sleuth-game series developed for hearing-impaired children in conjunction with the University of Nebraska's Barkley Memorial Center (see photos 2, 3, and 4). Designed to incorporate elements of a mystery story and an adventure game, Think It Through uses visuals from the disc and prompts generated by the computer to pose problems for the children to solve. Two discs are in the series, each with a different subject matter. But both use the same basic problem-solving approach: defining the problem, selecting a possible solution, and then testing the solution to see if it works. The game *Something's Missing* contains 76 different motion sequences. The terrific idea about these games is that when the computer is added, these sequences can be redesigned, frozen, accelerated, slowed down, and treated in an almost infinite variety of ways, which is the heart of the idea behind interactive video.

System Classification

Our general approach to all of this has been from a potential user's point of view. Our main interest is in what it takes to put together a usable system with emphasis on producing the discs themselves. (We have focused almost exclusively on optical reflective discs, otherwise called "constant angular velocity (CAV)," since optical transmissive discs are seldom used and most capacitance discs are not frame addressable.)

Because so many different types of videodisc players are on the market, we developed classifications based on the functional capabilities of the players in relation to their intended uses:

Level One: This includes "consumer" videodisc players, such as the Pioneer VP-1000 and Magnavox 8000. They are characterized as having individual frame addressability, worst-case frame access (1-54,000) less than 20 seconds, limited memory, and no processing power.

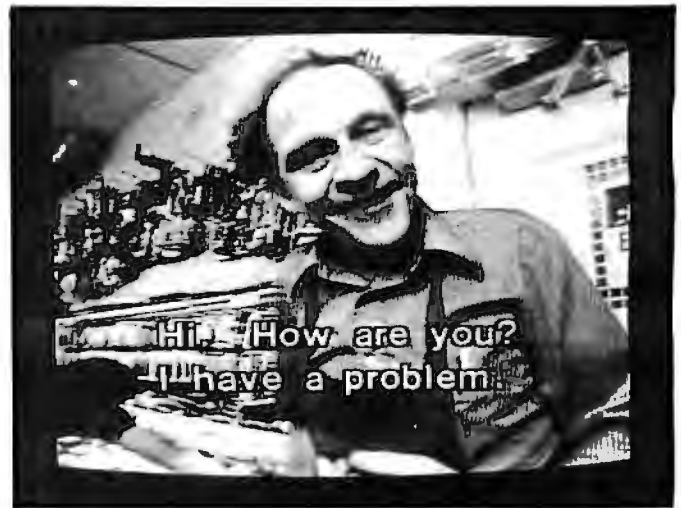
Level Two: These "industrial" videodisc players, such as the Sony LDP-1000 and the Discovision Associates (DVA) PR-7820, have the capabilities of level one, improved worst-case access times (the DVA PR-7820-3 is fastest at less than 4 seconds), two-way player/computer communication capabilities, and a built-in microprocessor.

Level Three: This level includes either a level-one or level-two videodisc player interfaced to a personal computer.

Actually, this classification also has a level zero, which includes players having no inherent capability for still/freeze framing and addressability, such as the CED (capacitance electronic disc) systems and optical discs designated as "extended play," or CLV (constant linear velocity). Also, a level-four group includes even more advanced systems.

Level One

The principal videodisc player in this category is the Pioneer VP-1000 (see photos 5 and 6). The VP-1000 is



2



3



4

Photos 2, 3, and 4: These photos are taken from an experimental videodisc/computer sleuth-game series for hearing-impaired children. In this game, called *Something's Missing*, Mr. Jones, the grocer, sets up the problem (some items are missing from his shelves). Open captions are video generated (photos 2 and 3), and the computer prompts the student via the "overlay" (photo 4).

	Magnavox Model 8000	Pioneer VP-1000	Sony LDP-1000	DVA PR-7820 1, 2, 3
Still frame	X	X	X	X
Step frame	X	X	X	X
Slow motion	variable	variable	1/5	variable
Fast play	forward x3	x3	x3	
Direct frame access		X	X	X
Scan/search	X	X	X	X
Remote control		option	X	X
Dual audio	X	X	X	X
Pause (CLV)	X	X		
Auto repeat	X	X		
Chapter stop	X	X		
Picture stop	*	X		
Programmable			X	X
Digital disc dumps			X	X
Worst-case access (secs)	20 +	18-20	5	2-5
Power	65 W	95 W	95 W	130 W
Weight	28 lb	39 lb	44 lb	54 lb

* With additional circuit board

Table 1: Comparison of videodisc-system capabilities. The table covers level one and two systems that are not interfaced to a microcomputer.



Photo 5: The Pioneer VP-1000 consumer (level-one) optical reflective videodisc player.



Photo 6: The Pioneer VP-1000's control panel. The VP-1000 is distinguished from other level-one players by its ability to directly access a videodisc frame and its remote-control unit.

capable of "searching" directly to any addressable frame on the disc, which is essential for interactivity and external control. Also, it has a remote-control unit, which means that all typical functions of an optical videodisc player (see table 1) come together in one place, the remote-control jack. The Magnavox 8000 is capable of displaying individual frames, but can only grossly access individual frames, much in the same manner as you thumb through a book to find a single page.

The Pioneer VP-1000 can read "picture stop" and "chapter" codes if they are encoded on the disc. A picture stop halts forward play of the disc on the frame where it has been encoded. Currently, with the VP-1000, the frame number has to be displayed. If this is not done, the player will ignore it (this may change in future versions). The Magnavox player requires a special circuit card to read picture stop codes.

The chapter code enables the VP-1000 to directly search to the first frame of a chapter. This is handy if you want to find a particular set of still frames or a motion sequence. The Magnavox player, since it cannot directly access single frames, finds chapters during a "scan" by sampling every 400 frames (also called the "landing pad").

Keep these features in mind. When you finally decide to connect your level-one system to your computer, picture stops and chapter codes can make your programming more economical.

Level Two

Only two level-two videodisc-player systems are currently on the market. The first is the DVA PR-7820 series Models 1, 2, and 3 (see photo 7). Models 2 and 3 differ because of two updates of the 7820's EPROMs (erasable programmable read-only memories). The second system is the Sony LDP-1000 (see photo 8). Sony also has a Model

2 with updated EPROMs. (A third videodisc player, the Thompson-CSF, has yet to get off the ground.) Before the release of the LDP-1000 in 1981, we had been using the reliable DVA players with no real complaints. We are now using both and are quite enthusiastic about the LDP-1000 because it offers some different features.

Level-two videodisc players are distinguished from level-one systems mainly by their programmability. You can program these players, on a limited basis, to execute a set of frame searches and autostops, to wait for input from the user, and to branch back into the programmed instructions accordingly. Programs can be recorded onto the second audio track of the videodisc and loaded into the videodisc player's RAM (random-access read/write memory). Multiple loads are possible, allowing maximum use of available memory.

The DVA PR-7820 Models 1, 2, and 3 contain F-8 microprocessors with 1023 bytes of RAM (initial memory locations per load). Commands and registers are stored in these locations. Each command takes up one byte. For example, if you want the player to find frame 1000, then play to frame 3000, the DVA commands would be:

Bytes	Command	Comment
1	1	
2	0	
3	0	
4	0	
5	Search	Find frame 1000
6	3	
7	0	
8	0	
9	0	
10	Autostop	Play to frame 3000

A more sophisticated program would use registers to accomplish the same task:

Program		
Bytes	Step	Command Comment
1	1	Recall 1000 Activates register 1
		Store 3000 Stores 1000 in 1, activates 2
2		Store 3000 Stores 3000 in 2
3	1	1
4	2	Recall 1000 Activates register 1
5	3	Search 1000 Frame 1000, activate 2
6	4	Autostop 3000 Play to 3000
7	5	Halt

This is useful if you want to save RAM, especially if your program searches and autostops frequently.

The Sony player also provides approximately 1023 bytes of initial memory, but there are a couple of differences. First, the idea of searching and autostopping is implied. The programming structure permits the user to



Photo 7: The Discovision Associates (DVA) PR-7820 "industrial" (level-two) optical reflective videodisc player. The DVA PR-7820's EPROMs have been updated twice (Models 2 and 3), resulting in faster search times and increased user-definable functions. Two-way communication between computer and disc is possible.



Photo 8: The Sony LDP-1000 (level-two) optical reflective videodisc player, which has a built-in RS-232C interface.

program up to 63 "segments" on two pages, totaling 512 lines (0-255 and 256-511). The other difference is that each command does not consume one memory location. Following the previous example, this is how the LDP-1000 would store a simple program:

Bytes (Lines)	Command	Comment
1	Stop	Stop on . . .
2	S001	Segment 1
3	Play	Play to the end of . . .
4	S002	Segment 2

You would then define the length of each segment like this:

Bytes	Command
1	Segment 1 = 1-1000
2	Segment 2 = 1000-3000

Listings 1a and 1b: Comparison between programs for the DVA PR-7820 and the Sony LDP-1000. Both programs perform the same function, but the Sony program is shorter because of its more efficient management of memory.

1a

A DVA PROGRAM:

```

00 0
01 1
02 RECALL
03 2
04 STORE      SET 2 IN REG 1
05 1
06 2
07 8
08 5
09 6
10 SEARCH     QUESTION 1
11 5
12 INPUT
13 0
14 1
15 1
16 BRANCH     0. DEFAULTS 0
17 2
18 9
19 BRANCH     1. TO CORRECT ANSWER
20 3
21 6
22 BRANCH     2. TO REMEDIATION
23 3
24 6
25 BRANCH     3. TO REMEDIATION
26 3
27 6
28 BRANCH     4. TO REMEDIATION
29 STP FWD    CORRECT ANSWER
30 1
31 0
32 WAIT       WAIT 1 SECOND
33 5
34 0
35 BRANCH     TO MUSIC
36 6
37 8
38 0
39 1
40 SEARCH     REMEDIATION START
41 7
42 3
43 1
44 0
45 AUTOSTOP   REMEDIATION END
46 1
47 DEC REG    SUBTRACTS 1 FROM REG 1
48 5
49 BRANCH     TO QUESTION 1
50 1
51 2
52 8
53 7
54 0
55 SEARCH     MUSIC START
56 1
57 3
58 2
59 7
60 0
61 AUTOSTOP   MUSIC END (NEXT QUES)
62 HALT

```

1b

A SONY PROGRAM DESIGNED TO DO THE SAME THING:

SEGMENTS:

```

01 13016-13016
02 13017-13017
03 06931-07740
04 13032-13431

```

PROGRAM:

```

00 REG 0=      SET REGISTER
01 002
02 STOP
03 S001        QUESTION 1
04 000        WAIT INDEFINITELY
05 INPUT
06 1-016      1. (A) TO CORRECT ANSWER
07 2-010      2. (B) TO REMEDIATION
08 3-010      3. (C) TO REMEDIATION
09 4-010      4. (D) TO REMEDIATION
10 J=0        JUMP IN REGISTER 0
11 021        JUMP TO REMEDIATION
12 PLAY
13 S003        (PLAY WHEN REG 0=0)
14 GOTO
15 025        TO MUSIC
16 STOP
17 S002        CORRECT ANSWER
18 001        WAIT 1 SECOND
19 GOTO
20 025        TO MUSIC
21 PLAY
22 S003        REMEDIATION
23 GOTO
24 002        TO QUESTION 1
25 PLAY
26 S004        MUSIC SEGMENT (NEXT QUESTION)
27 END

```

Entering actual segment locations into memory does not affect the number of lines available for entering commands.

Listings 1a and 1b are more complex programs that exercise most of the programming capabilities of the DVA and Sony players. Assume that you have just seen a video sequence on the screen. The videodisc player is now waiting for you to input an answer to a multiple-choice question (four choices). You have two chances to make the correct choice. If you get the right answer, the program will step the disc player forward to a feedback frame, wait one second, play some music, and stop at the next question. If you get it wrong, the program will "search" and return you to the previous video sequence (remediation) to jog your memory, and then branch back to the same question. If you are wrong again, the disc will branch directly to the music and stop on the next question. From the listing, you can see that the Sony player is more economical with memory space than the DVA player.

Some problems exist, however, with using a bare-bones level-two system. First, you cannot just enter these



Photo 9: *The Discmaster 5000 by New Media Graphics, a complete level-three system using the Pioneer VP-1000 and an Atari 400 computer.*

programs into the players' memories and run them with any old videodisc. Significant frame locations, such as menus, questions, feedback frames, etc., must first be written and recorded onto video tape in an entirely separate environment (called postproduction or premastering). Once the significant frame locations, the program, and the video have been mastered onto a disc, it becomes a "video ROM (read-only memory)," which can cause another, more frustrating problem. If there is a bug in the program (e.g., the video player looks for the wrong frame number), the mistakes must be corrected by remastering the entire disc. DVA will provide a "proof" disc upon request so that programming can be verified prior to replication. You can also have your program simulated with a computer-controlled video-cassette or video-tape recorder (VTR) prior to mastering and replication, which seems to be a better solution (more on this later). Either way, producing an interactive videodisc is a "top-down" situation that can end up costing a lot of time and money if you are not careful.

The level-two videodisc players are faster than level-one systems, they are more rugged, and they provide better control capabilities for the user (because of the microprocessors). As stand-alone systems, however, they have some limitations.

Level Three

Level-three systems consist of either level-one or level-two videodisc players interfaced to a personal computer. Because there aren't any standards for videodisc players and due to the conflicting needs of videodisc producers and users, the interface can take many forms: those made exclusively for the Pioneer VP-1000; those designed to accommodate several disc players; interfaces made exclusively for Apple II, TRS-80, Atari, and custom-built computer systems; and generic interfaces made for any computer. Some interfaces are also designed to either switch (or "flip") back and forth from the computer's video output to the videodisc image or "key" the text/graphics from the computer directly onto NTSC video. Here are just a few examples of what's available.

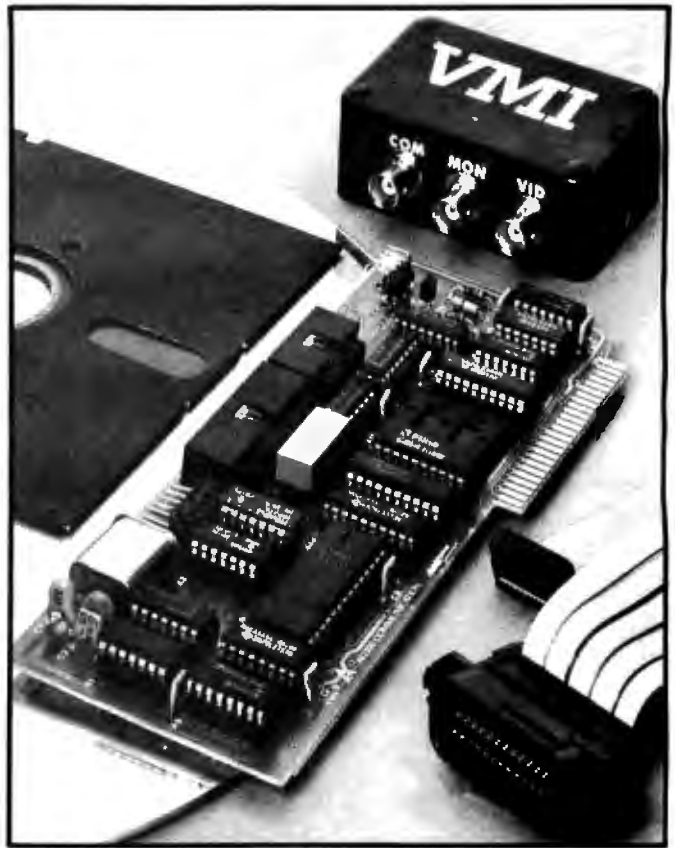


Photo 10: *The VMI by Allen Communication, an interface designed for the Apple II and almost every optical reflective videodisc player.*

Discmaster 5000 by New Media Graphics (see photo 9) is designed for the Pioneer VP-1000. This complete system includes an Atari 400 with 16K bytes of memory, Atari BASIC, floppy-disk drive, the New Media Graphics interface with a built-in Z80 processor (RS-232C serial), all necessary cables, connectors, user documentation, and the Pioneer VP-1000. Martin Duhms, its president, says, "New Media Graphics has now done the necessary system integration to deliver a ready-to-use system at a price comparable to what industrial videodisc players sell for by themselves. Also, the Discmaster 5000 allows complete reprogramming in BASIC of the videodisc playback, which the other players don't." New Media Graphics also offers the Discmaster 1000, which is similar to the Discmaster 5000 minus the Atari 400 and the Pioneer VP-1000. New Media Graphics, 139 Main St., Cambridge, MA 02142, (617) 547-4344.

Another system for the Pioneer VP-1000 is the Omniscan by Aurora Systems Inc., which uses an Apple II as the exclusive controller. The Apple duplicates the operation of the Pioneer VP-1000's keypad and automatically "flips" the video between the computer's output and standard video. The Omniscan includes the interface, documentation, and a tutorial on the software (the Apple II and Pioneer VP-1000 are extra). Aurora Systems Inc., 2040 East Washington Ave., Madison, WI 53704, (608) 249-5879.

The VMI by Allen Communication (see photo 10) is

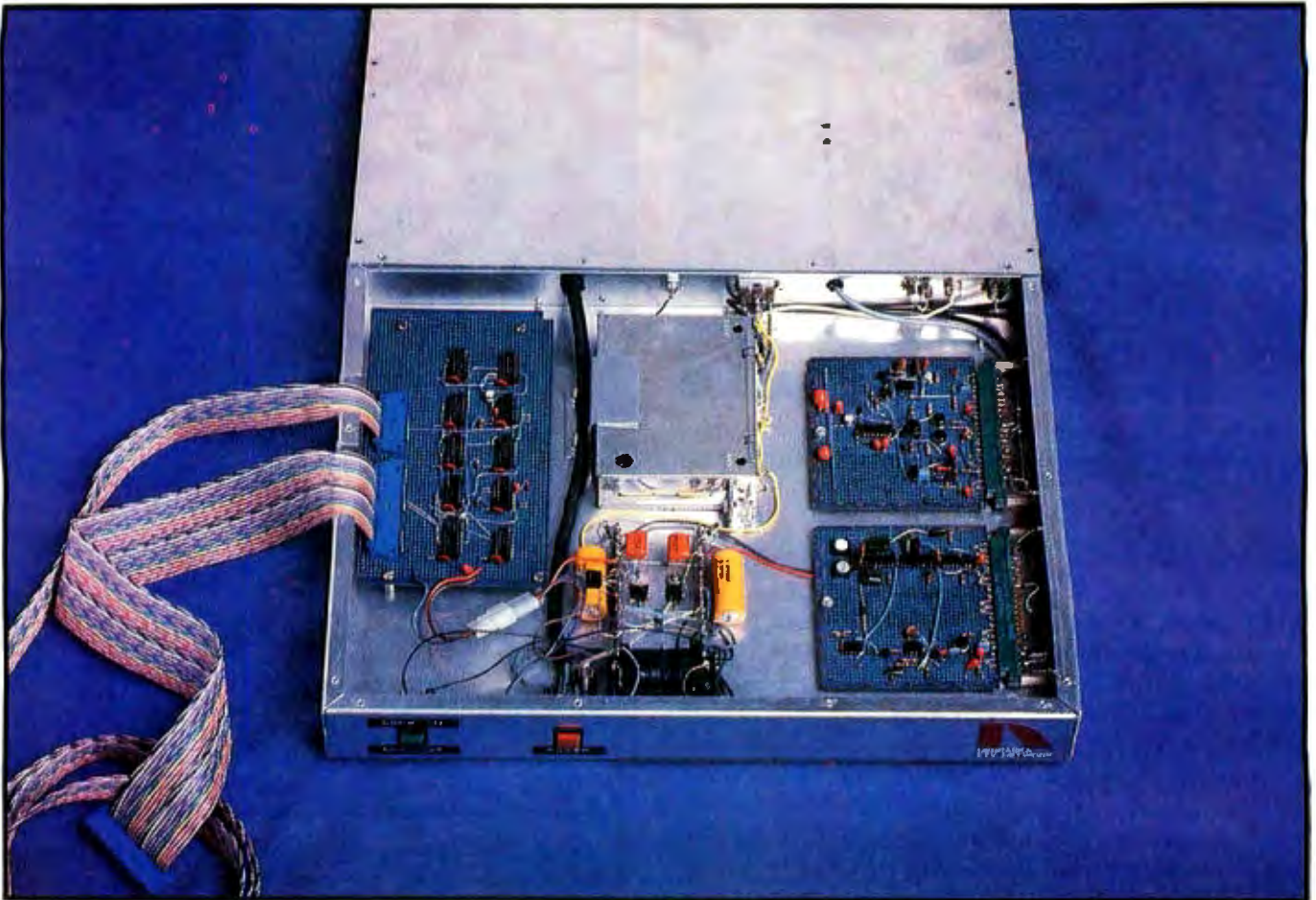


Photo 11: The first-generation "wire-wrapped" model of the "overlay" interface for the TRS-80 Model I, by the Videodisc Design/Production Group. The second-generation unit (not shown) is designed as a "plug-in" inside the TRS-80 Model III and uses the Model III's RS-232C port.

also designed exclusively for an Apple II, but it can drive every existing optical videodisc player with the exception of the Magnavox 8000. The VMI includes an extremely well-documented user's manual, the interface, switching box, cables, software, information packet, and a sample videodisc. Allen Communication, 3004 Arapahoe Ave., Boulder, CO 80303, (303) 449-2971.

Some systems are based on a company's own personal computer, such as the Positron system by Ron Lane. This is a hardware and software system that arranges interactive strategies hierarchically. Still frames, motion, and text can be selected from five types of displays: (1) outline, in any level of detail; (2) dictionary; (3) questions; (4) titles that relate to a particular frame; and (5) titles previously selected. The nice thing about the Positron system is that its application to program development requires no computer programming or storyboarding of the video, which are two of the main bottlenecks in interactive videodisc production. Information need only be listed; Positron controls everything else, including the interaction. The Positron system comes with its own specially built microcomputer (64K bytes of memory), disk drive, special keyboard, interface, software, and operating system (the Pioneer VP-1000 is extra). Ron

Lane, Positron, 30 Lincoln Plaza, Suite 3S, New York, NY 10023, (212) 586-1666.

Another such system is the Random Access Video Controller (RAVC), supported by a 68000-based microcomputer, developed by Wicat Systems. The RAVC uses the TI 9900 microprocessor for on-board intelligence with 16K bytes of video RAM. It works with any available commercial optical videodisc player, including the Magnavox 8000 if some modifications are made to the player. The controller has both serial and parallel ports for interfacing to the videodisc player. In addition to player control, the RAVC also has a TI 9981 video-processor chip (the same chip as in the TI 99/4 home computer) that provides it with its own video-display capabilities. It can generate screens with 16 different background colors and 16 character colors. Like the 99/4, the controller board can create different video planes for animation. Wicat Systems, 1875 South State St., POB 539, Orem, UT 84057, (801) 224-6400.

Another type of interface falls into the category of "video reprocessing." This, very simply, is the process of converting the video from the computer to mix with the 525-line NTSC standard television.

Sanders Associates has developed a video-reprocessing

system made for an Apple II, called the Interactive Video Training System (ITVS). Besides being able to mix Apple-generated text and graphics with NTSC video, the ITVS can also carry digital data "nested" unseen in the NTSC video signal. This data can be used to define the location of an object, download instructions to the computer on the rules and procedures needed for a given sequence, overlay Apple/NTSC text and graphics symbols on the video picture, and control the functions of the VTR or videodisc player. Sanders Associates Inc., 95 Canal St., Nashua, NH 03060, (603) 885-3731.

Another video-reprocessing system designed for the Apple II is available from Video Associates Labs Inc. The VB-3 Micro-Keyer allows the Apple II to be used for both video production and training. It comes with software that allows a person with no technical knowledge of video or computers to take full advantage of the broadcast features built into the VB-3 Micro-Keyer system. Video Associates Labs Inc., 2304 Hancock Dr., Suite 1-F, Austin, TX 78756, (512) 459-5684.

This type of system is marketed primarily to television stations. For example, they use it to key weather maps, forecasts, etc., directly onto the screen during news programs. While they are considered real bargains compared to the cost of the other broadcast equipment, unfortunately, most video-reprocessing systems cost more than the personal computer that controls them.

The Videodisc Design/Production Group

In April 1980, the Nebraska Videodisc Design/Production Group demonstrated the first version of the overlay interface (see photo 11). Like other video-reprocessing systems, this configuration is also a true keyer. But being able to key is merely the end result. "Interlace" is accomplished prior to keying. The overlay interface is designed exclusively for the TRS-80 Models I and III. Focusing on the TRS-80 enabled us to build the keyer minus expensive signal processing, making the system affordable to the personal computer user at home, at school, or on the job. While the overlay contains a decoder for turning the video on and off, it also permits interaction between text/graphics generated by the computer and television images, which is preferable in our book to merely switching back and forth from computer to videodisc.

The utility software package designed to control our level-three discs is called the VDC-1 (videodisc controller). The package, written in Z80 assembly language, is designed to be called from disk BASIC, although it is possible to call it directly from assembly language, or even from FORTRAN or some other high-level language. A common subset of disc player functions is provided, and it is possible to extend the capabilities of the package by adding custom functions. It is also possible to download or perform data dumps to players that have internal intelligence (e.g., DVA PR-7820 and the Sony LDP-1000). Macros are also allowed, making it possible for the programmer to send a string of commands that are frequently used or requested, thus saving time and memory.

Some of the internal (housekeeping) functions include initialization, a manual mode, player-definition mode, and frame lock-out. Initialization consists of telling the VDC-1 which player is connected to the TRS-80. The VDC-1 asks the user which videodisc player is being used and then performs all functions transparently. For example, if your BASIC program was written using the DVA PR-7820 as a development system, the program could run in the field with a Pioneer VP-1000. The VDC-1 is designed for that kind of compatibility.

In addition to the standard keyboard functions that can be accessed manually, the VDC-1 supports the decoding functions of the overlay with video on/video off commands so that the computer can continue to display information while the player searches to a location. This is particularly applicable for the Pioneer player (worst-case access: 18-20 seconds). Other commands include lock-out functions for both frame locations and the player panel, timing and pause commands for CLV discs, and "bookmark" commands that switch from computer control to manual control and resume again where the user had previously left off.

Videodisc Production

Designing and producing an interactive videodisc is similar to writing, producing, and directing a film. Hidden in both the film and disc development are layers of various media (including computer software) and hours of evaluation in many forms. What really sets interactive videodisc development apart from the development of motion pictures or television productions, however, is interactivity, the dynamic interplay between the user and the medium—which neither film nor television can provide. Yet, as we have learned something about developing interactive discs, as producers, we have also learned that we are using yesterday's tools to develop tomorrow's media. [Editor's Note: To give you a better understanding of the various steps involved in the production of an interactive videodisc, we have included a design and production chart on pages 56 and 57. . . . S. J. W.]

Our pet project (and pipe dream) for the last two years has been the development of an interactive editing system (IES), which could individualize the postproduction process in the same way that filmmaking is individualized during the editing process. The requirements for an IES as we see them include read-write capability, rapid-frame access, broadcast quality, the ability to reedit, simulation capabilities, and portability. The IES would be a computer-controlled offline system. Under ideal circumstances, the computer would be involved from the design process, flowcharting, creating visuals, etc., right up to the final coding of the finished product.

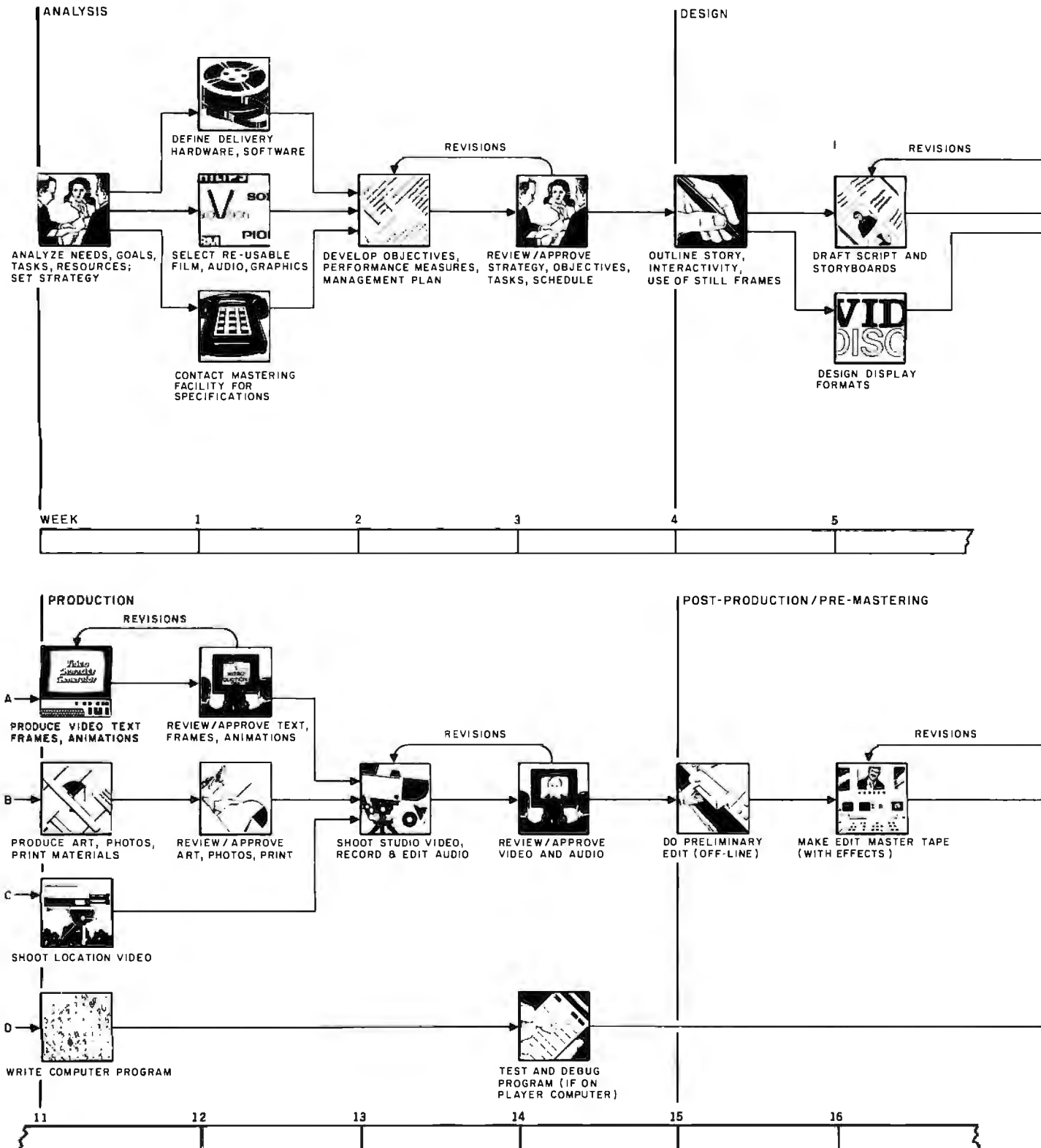
The first signs of an IES are beginning to appear. We are blessed with a first-rate teleproduction facility, and as we move further into the digital world, we are able to piece things together.

The current IES configuration is based on a Bosch BCN-50, a 1-inch helical VTR, controlled by an 8080 microprocessor with an RS-232C serial interface, de-

Text continued on page 58

Interactive Videodisc

The design and production chart shows the steps required to design, develop, and produce an interactive videodisc. The individual steps vary in length and complexity. Although some activities may overlap in practice, each step in the sequence depends on the successful completion of the steps leading up to it. A critical stage occurs at the beginning, when the client and subject-matter experts define the goals and objectives for the videodisc program. The participation of the client is also essential at every "review/approve" step (marked by a "revision" path back to the previous step).



Design and Production

The schedule shown here—20 weeks from concept to master tape—suggests the time typically recommended for a well-managed project of medium complexity, using primarily studio production (with one or two scenes shot on location), about 400 still frames, and a modest computer program. Simpler projects require less time, while those employing sophisticated computer-simulation techniques take longer, both to produce and to plan. For videodiscs controlled by an external computer system, program coding and testing can continue during the mastering of the videodiscs.

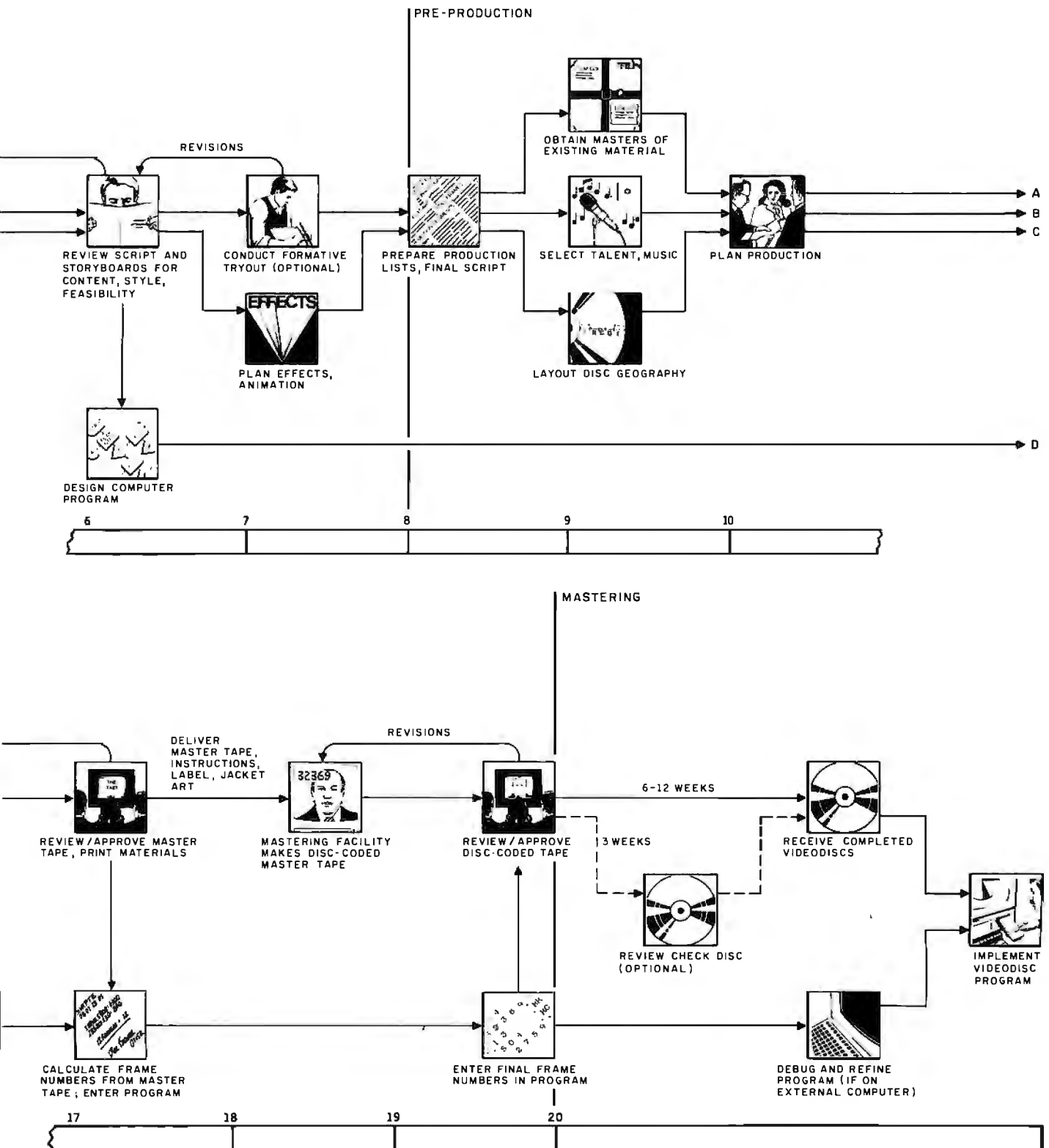




Photo 12: A videodisc simulator/editor developed by the Videodisc Design/Production Group. The Bosch BCN-50 1-inch helical VTR (left) serves as a surrogate disc player but with the added capability of offline insert edit capability with "broadcast quality."

Text continued from page 55

signed and built by our group (see photo 12). Using this standard interface, the BCN-50 can be driven by almost any external source. The 8080 system already had programming in EPROMs to control the tape transport and still store functions. The main task was to locate and con-

trol the subroutines stored in the EPROMs and write a "driver" program to access and execute them in a manner that would duplicate the capabilities of a videodisc player. Once the driver was completed, software was developed that recognized inputs from any given disc player. From there, the user-oriented software could be written.

Since the Bosch machine is a broadcast-quality recorder with full editing capabilities, it operates by the same SMPTE time code used to assemble materials on-line. Also, since it is a recorder with frame-accurate editing capability, part of the tape can be edited offline to revise a text frame or menu, for example.

Once the premastering stage has been completed and a finished tape is available, the master can be made. The coded tape is sent to a mastering facility, where a master is made on a glass disc. This master is then used to produce the finished videodisc.

Into the Future

The videodisc has almost unlimited potential. Programs will appear that are made for interactive use, including games, educational programs, simulations, and more. The future of interactive videodisc technology could be as bright as the microcomputer industry itself, and the videodisc may become the medium of the eighties. ■

Glossary

(This information can also be found in 3M's Producing Interactive Videodiscs manual.)

authoring: a structured approach to developing all elements of an interactive videodisc program with emphasis on preproduction.

branch: an instruction to diverge from one sequence in a program to another.

capacitance disc: a videodisc system that uses capacitance signals embedded on the disc and a stylus that touches the surface of the disc to read encoded information.

CED: capacitance electronic disc developed by RCA.

chapter: a consecutive sequence of frames.

chapter stop: a code embedded in the vertical interval of the videodisc that enables certain videodisc players (mostly level one) to locate the beginning of chapters.

compressed audio: sometimes called still frame audio, compressed audio describes a method

of digitally encoding and decoding several seconds of voice-quality audio per individual disc frame, resulting in a potential for several hours of audio per disc.

constant angular velocity (CAV): a CAV disc revolves continuously at 1800 rpm, one revolution per frame, making each frame of a CAV disc addressable, a basic requirement for interactive videodiscs.

constant linear velocity (CLV): a CLV or extended-play disc maintains a consistent length for each frame, thus enabling longer playing time per side, but sacrificing individual frame addressability. Reference to locations on CLV discs is limited to time in minutes and seconds. CLV discs are basically useless for interactive videodisc applications.

cue: a pulse entered onto one of the

lines in the vertical-blanking interval (VBI) that results in frame numbers, picture codes, chapter codes, closed captions, white flags, etc., on the disc.

direct-read-after-write (DRAW): a record-once optical-disc technology primarily used for mass storage of digital data.

field: a scan of 262 lines on the screen at 1/60 second constituting one-half of a complete video frame. See **frame**.

flicker: sometimes known as "interfield jitter" or "jitter," flicker is a phenomenon that occurs in a videodisc freeze frame or still frame when both fields are not identically matched, thus creating two different pictures alternating every 1/60 second.

frame: two complete scans of the video screen at 1/30 second. A frame is composed of two fields (at

262 lines) and a retrace; a single frame is a standard CAV videodisc reference point. There can be as many as 54,000 addressable frames on one side of a CAV videodisc.

freeze frame: a single frame from a motion sequence that is stopped.

full frame time code: otherwise known as nondrop frame time code, full frame time code is a standardized SMPTE (Society of Motion Picture and Television Engineers) method of addressing a video tape. It gives an accurate frame count rather than an accurate clock time.

interaction: a reciprocal dialogue between the user and the system, interactivity.

interchangeability: a videodisc design strategy that includes information readable on consumer, industrial, and computer-controlled videodisc systems.

interlace: in NTSC video, half the horizontal scanning lines are laid down. After retrace, the other half are laid down so that they fall in between the previous lines.

intermediate materials: all media selected for assembly onto the videodisc premaster (i.e., 16mm film, video tape, 35mm slides, etc.).

jaggies: a tearing phenomenon around the edges of NTSC images. Research at MIT has effectively solved this problem. By so doing, it has created a new way of thinking about displays, computer graphics, and NTSC video. See **soft fonts**.

keyer: it cuts a hole in the background video and fills in the hole from a different video source, i.e., computer-generated text and graphics keyed over NTSC video. See **video reprocessing**; **overlay**.

landing pad: a range of frames within which a player can locate a frame or frame sequence. Landing pad (LPD) is also a command that modifies the number of times a player attempts to locate a frame following an unsuccessful search.

level of interactivity: the potential for interaction prescribed by the

capabilities of videodisc hardware.

level one: usually a consumer-model videodisc player with still/freeze frame, picture stop, chapter stop, frame addressability, and dual-channel audio, but with limited memory and less processing power.

level two: an industrial-model videodisc player with the capabilities of level one, plus on-board programmable memory and improved access times.

level three: level-one or level-two players interfaced to an external computer.

level four: a theoretical configuration with more advanced equipment wherein all things are possible.

mastering: a real-time process in which the premaster video tape is used to modulate a laser beam onto a photosensitive glass master disc.

NTSC: the American television standard set at 525 lines by the National Television Standards Committee.

optical disc: a videodisc that uses a light beam to read information from the surface of the disc.

optical memory: digital data encoded on an optical disc used for mass data storage. It is estimated that one side of an optical disc could store up to 10 billion bits.

overlay: a term used to describe the keying of computer-generated text/graphics onto NTSC video.

picture stop: an instruction encoded in the vertical interval on the videodisc to stop the videodisc player on a predetermined frame.

postproduction premastering: sometimes called video processing, this is the process of editing, assembly, evaluation, revision, and coding of intermediate materials. A premaster is a fully coded video tape.

preproduction: all design tasks, e.g., flowcharting, storyboarding, scriptwriting, software design, etc., prior to videodisc production.

reflective (optical) disc: method by which the laser beam reads data

encoded on an optical videodisc. In the case of a reflective disc, the laser beam is reflected off the shiny surface on the disc.

scan: to traverse the surface of the disc with the video displayed.

search: to rapidly access a single frame or a sequence of frames on a disc with video off.

sequence: two or more frames forming one unit, e.g., motion sequence, still-frame sequence.

slow motion: in videodisc technology, the controlled movement of the laser from frame to frame at a variable rate of less than 30 frames per second.

soft fonts: a gray-level scheme developed by MIT for high-quality fonts in NTSC video. This adds legibility, removes scintillation, and enhances encodability, which results in a display with more than 80 characters per line on a color-television receiver.

step: to advance one frame forward or reverse.

still frame: still material, including photographs, line drawings, pages, etc., designed and presented as a single videodisc frame.

three-two (3-2) pulldown: a means of transferring film shot at 24 frames per second (fps) into video (30 fps). The first film frame is actually exposed on three video fields, and the next film frame is exposed on two fields.

transmissive disc: method by which the laser beam reads data encoded on an optical videodisc. In the case of the transmissive disc, the laser beam passes through the transparent surface of the disc.

vertical-blanking interval (VBI): 21 blanked lines during field 1 and 21 blanked lines during field 2, wherein frame numbers, picture stops, chapter stops, white flags, closed captions, etc., are encoded.

VHD: video high density (see **capacitance disc**).

video reprocessing: the process of keying video from the computer over NTSC video.

white flag: a code that identifies a new film frame.

Galactic Chase

Stan Wszola
Technical Editor

I have this recurring nightmare in which I'm trapped in a video arcade and forced to play the games endlessly. Unfortunately, all the games are identical. I suppose these dreams are the result of seeing too many arcade-game clones. It seems as if everybody and his brother is producing arcade look-alike games for the personal computer market.

Fortunately, *Galactic Chase* is no nightmare; it's an implementation of the successful *Galaxians* arcade game with some interesting variations.

The Game

Following the *Galaxian* theme, the object of the game is to shoot the alien ships. At the start of the game, a fleet of 36 alien ships appears, arrayed in ranks (see photo 1). The value of an alien ship depends on whether it is still in formation or moving in for an attack (see table 1). Not only is it more sporting to



Photo 1: Screen display for *Galactic Chase*. Two of the alien ships are shown peeling off from the formation and moving in for an attack.

shoot them while they're moving, but they're worth more points then.

When the game begins, the aliens peel off from the formation and attack individually. Rather than make a straight descent toward the bottom of the screen, the aliens swoop and curve, raining their missiles upon you all the time. In flight, the aliens appear to be little gloves trying to grab your ship. The movement of the alien ships is very smooth and looks quite good on the screen.

Your Role

As the *Final Defender of Space*, you command three

ships per game. Your ship is controlled by the Atari joystick, and you fire missiles by pressing the button. You can destroy the alien ships either by firing missiles at them or by having the aliens collide directly with the *magnetic repellers* at the front of your ship.

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Ships	Number	Point Value	Attack Value
Ensigns	20	20	40
Captains	7	30	60
Flankers	6	40	80
Command Ships	2	50	100 to 400

Table 1: The variety, number, and point values of the ships in the alien fleets.

In this game, there is nowhere to hide. You can't duck behind a convenient barricade. Your ship is out in the open, so the game requires a lot of movement to dodge the alien missiles and ships. The game is a true test of eye-hand coordination.

When you destroy one fleet of alien ships, another will take its place. You receive a bonus ship at the start of your encounter with the 16th, 32nd, and 48th fleets. You also get a bonus ship for each 7000 points scored.

The game is set up for one or two players, with the players taking turns. The current scores are displayed at the bottom of the screen, as are the highest score achieved and the number of fleets encountered from the previous game.

One nice feature is that you can stop and restart the action by pressing the Control-1 keys. This is especially convenient if the action becomes hot and heavy and suddenly the phone rings.

Options

The game has three levels of skill. After you have destroyed 10 fleets in level one, you are moved up to level two, where the speed of the aliens increases. At your en-

At a Glance

Name

Galactic Chase

Type

Arcade-type game

Manufacturer

Spectrum Computers
26618 Southfield Rd.
Lathrup Village, MI 48076
(313) 559-5252

Price

\$24.95, cassette;
\$29.95, disk

Author

Tony Weber

Format

Cassette tape or 5¼-inch floppy disk

Language

6502 machine language

Computer Needed

Atari 400 or 800 with 16K bytes of memory, one disk drive, and two joysticks

Documentation

One-page pamphlet

Audience

Game players

counter with the 31st fleet, an *invisible ray* disables your missile launcher and slows the speed of your missiles. This is level three. You also have the option of starting at level two if you find level one too tame.

Strategy

Conventional wisdom suggests that the safest approach is to shoot the alien ships one column at a time. However, another strategy is to destroy the alien ships only while they're in motion. You'll acquire more points if successful, but your ships will face the greatest danger. You might reserve this strategy for the command ships; one command ship can be worth up to 400 points. (The value is determined randomly and is displayed when you hit the ship.)

My usual *modus operandi* is to keep my ship in constant motion. I've found that if you concentrate on one specific target or column, it's easy to pick off ships. Also, the alien ships tend to follow the motion of your ship, so radical changes in direction will throw them off your track.

As I mentioned above, alien ships can be destroyed by

ramming them with the front of your ship. The latter tactic is *not* for the fainthearted. Because the alien ships are firing directly ahead, you must wait till the last moment before placing your ship in the path of the alien. If the alien should touch the side of your ship, both ships will be destroyed. This tactic, therefore, is only for macho game players or for use as a last-ditch effort.

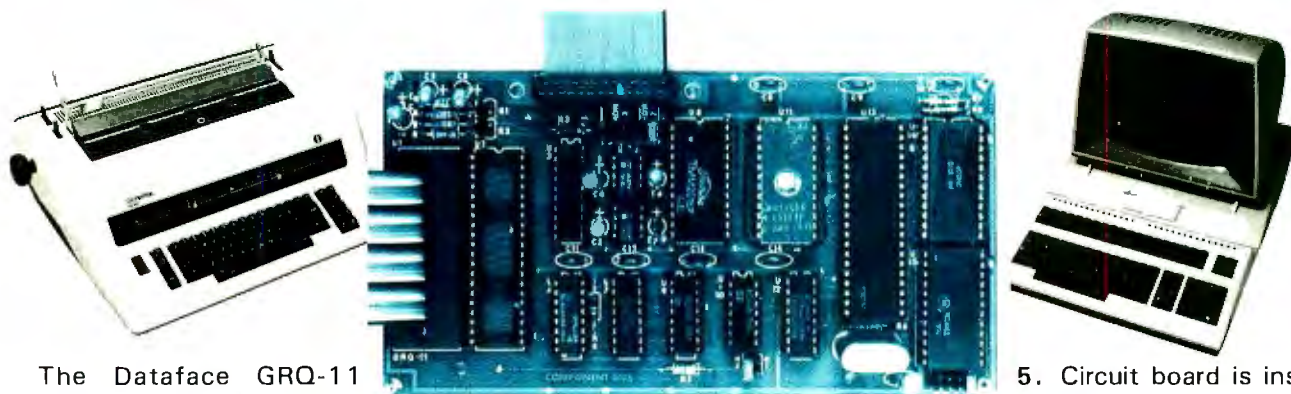
Conclusions

●I have only two complaints. I dislike the bursts of light in the background. Obviously meant to represent flickering stars, the effect looks more like cosmic dandruff. Also there is no software switch to turn off the sound effects. (My fellow editors did not appreciate hearing all of the galactic mayhem while they were trying to work.) These minor points become irritating if you play the game for any length of time.

●Galactic Chase is faithful to the original version. It offers an exciting game with a maximum of action and a minimum of complications. The graphics are smooth and colorful, and all information is nicely displayed. Galactic Chase is a natural for any Atari owner's game library. ■

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The Atari Tutorial

Part 10: Human Engineering

The interaction between the computer and its human user is easily the most important—and most often neglected—aspect of commercial software.

Chris Crawford
Atari Inc.
1265 Borregas Ave.
POB 427
Sunnyvale, CA 94086

The Atari home computer is first and foremost a consumer computer, being designed to make it easy for people to use. Many of the hardware features protect the consumer from inadvertent errors. Because the average consumer is unfamiliar with the conventions and traditions of the computer world, software should reflect an equal concern for the consumer. If a program is understandable, it will be used correctly most of the time. Occasionally, a user will be careless and make mistakes. It is the programmer's responsibility to protect the user from as many mistakes as possible.

Human engineering refers to the interaction between the design of tools and the resulting ease of use by people. The current state of human engineering found in personal computer software is dismal. Many programs

being sold contain atrocious design decisions that reflect unawareness of human engineering. Although the worst offenders are written by amateur programmers, even software written at some of the largest firms shows occasional lapses in this respect.

Can you imagine what Star Raiders would be like without animation?

Human engineering is an art, not a science. It demands great technical skill, but it also requires insight and sensitivity. As such, it is a highly subjective field devoid of absolutes. Since this article is the work of one hand, it betrays the subjectivity of its author. A full treatment of the many opinions on the subject would be both lengthy and confusing. I therefore chose the simpler and more pleasant task of presenting only my own point of view, giving appropriate lip service to the most serious objections. The result is contradictory enough to satisfy even the most academic of readers.

The Computer as a Sentient Being

An instructive way of viewing the problem of human engineering is to cast the programmer as a sorcerer who conjures up an intelligent being, a *homunculus*, within the innards of the computer. This creature lacks physical embodiment but possesses intellectual traits—specifically, the ability to process and organize information. Although the user of the program enters into a relationship with this homunculus, these two sentient beings think differently. The human's thought patterns are associative, integrative, and diffuse; the program's thought processes are direct, analytical, and specific. These differences *are* complementary and productive because the homunculus does well what the human cannot. Unfortunately, these differences also create a communications barrier between the user and the homunculus. They have much to say to each other because they are so different, but because they are different they cannot communicate well.

The central aim of good programming should therefore be to provide better communications between the user and the homunculus. Sad to say,

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many programmers expend the greater part of their efforts on expanding and improving the processing power of their programs. This only heightens the tragedy by increasing the intelligence of the homunculus while leaving him blind, deaf, and dumb.

Today's personal computers have sufficient computing power to meet many of the average consumer's needs. The primary limiting factor is no longer clock speed or resident memory; the primary limiting factor is now the thin pipeline connecting our now-intelligent homunculus with his human user. Each can process information rapidly and efficiently; only the narrow pipeline between them slows down the interaction.

Human-Machine Communication

How can we widen the pipeline between the two thinkers? We must focus on the language with which they communicate. Like any language, a man-machine language is re-

stricted by the physical means of expression available to the speakers. Because the computer and the human are physically different, their modes of expression are physically different. This forces us to create a language that is not symmetric (as human languages are). Instead, a man-machine language will have two very different channels: an input channel and an output channel. Just as we study human language by first studying the sounds that the human vocal tract can generate, we begin by examining the physical components of the man-machine interface.

Output (Computer to Human)

Two primary output channels go from the computer to the user. The first is the television screen; the second is the television speaker. Fortunately, these are flexible devices that permit a broad range of expression. For the purposes of this article, it is better to discuss these devices in terms of the human point of view. Of

the two devices (screen and speaker), the display screen is easily the more expressive and powerful device. The human eye is a more finely developed device for gathering information than the human ear. An electrical engineer might say that the eye has more "bandwidth" than the ear—that is, it can interpret a far more complex input stream. The eye can process three major forms of visual information: shapes, color, and animation.

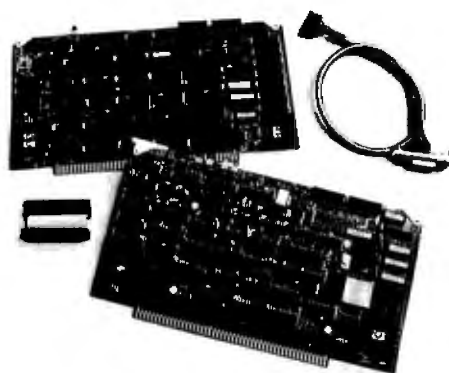
Shapes

Shapes are an ideal means for presenting information to the human eye. The human retina is especially adept at recognizing shapes. The most direct use of shapes is for the depiction of objects. If you want the program to tell the user about something, draw a picture of it. A picture is direct and immediately recognizable.

The second use of shapes is for symbols. Some concepts in the human lexicon defy direct depiction. Concepts like love, infinity, and direction cannot be shown with pictures. They must instead be conveyed with symbols, such as a heart, a horizontal figure 8, or an arrow. These are a few of the many symbols we all recognize and use. Sometimes you can create an ad hoc symbol for limited use in your program. Most people can adapt to such a symbol quite readily. Although symbols are a compact way to express an idea, they should not be used in place of pictures unless compactness is essential. A symbol is an indirect expression; a picture is a direct expression. The picture conveys the idea more directly and more forcefully.

The third and most common use of shapes is for text. A letter is an indirect symbol; we put letters together to form words. The language thereby produced is extremely rich in its expressive power. Truly it is said, "If you can't say it, you don't know it." This expressive power is gained at the price of extreme indirection. The word that expresses an idea has no sensory or emotional connection whatever with the idea itself. We are forced to carry out extensive mental

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gymnastics to decipher the word. Of course, we do it so often that we have become quite fluent at translating strings of letters into ideas. We do not notice the effort. The important point is that the indirection detracts from the immediacy and forcefulness of the communication.

One school of thought maintains that text is superior to graphics for communication purposes. The gist of the argument is that text encourages freer use of the reader's rich imagination, while graphic depiction of reality always falls short of our imaginative expectations. This argument fails to convince me because it seems to arbitrarily draw a line between the user's need for information and the ability to supply information through the use of imagination. If the user has an active imagination, why is the program needed at all? Why doesn't the user simply imagine the entire program? Conversely, if a small amount of information provided in the form of text is the seed for the user's imagination, would not

more information, provided in the form of graphics images, encourage even grander flights of imaginative fancy? An equal exercise of imagination with graphics should provide even greater results.

The eye can process three major forms of visual information: shapes, color, and animation.

A more compelling argument for text is that its indirection allows it to pack a considerable amount of information into a small space. The space constraints on any real communication make text's greater compactness valuable. Nevertheless, this does not make text superior to graphics; it simply makes text more economical. Graphics requires more space, time, memory, or money, but it also com-

municates better than text. To some extent, the choice between graphics and text is a matter of taste, and the taste of the buying public has never been in doubt. Compare the popularity of television with that of radio, or the popularity of movies with books. Graphics beats text easily.

Color

Color is another vehicle for conveying information. Since it is less powerful than shape, it normally plays a secondary role in visual presentations. Its most frequent use is to differentiate between otherwise indistinguishable shapes. It also plays an important role in providing cues to the user. Good color can salvage an otherwise ambiguous shape. For example, a tree represented as a character must fit inside an 8- by 8-pixel grid. The grid is too small to draw a recognizable tree. By coloring the tree green, however, the image becomes much easier to recognize. Color is also useful for attracting attention or signaling important

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material. Hot colors attract attention. Finally, use of color enhances the aesthetic appeal of any program. Colored images are more pleasing to look at than black-and-white images.

Hard-boiled programmers may question the relevance of aesthetic considerations to communications. The obvious attention to the design of highway advertising billboards and television commercials indicates the importance our culture attaches to the aesthetic aspect of communication. These carefully planned and very expensive ads are little more than exquisite aesthetic trappings (skin, glitter, and chrome) wrapped around a corporate logo.

Animation

I use the term *animation* here to designate any change in the display. Animation includes colors or shapes that change, moving foreground objects, or a moving background pattern. Animation's primary value is for showing dynamic processes. Indeed, graphics animation is the only way to successfully present highly active events. The value of animation is best demonstrated by a game like *Star Raiders*. Can you imagine what the game would be like without animation? For that matter, can you imagine what it would be like in pure text?

The value of animation extends far beyond games. Animation allows the designer to show dynamic, changing events clearly. The ability to do animation is one of the major advantages that computers have over paper-and-ink as an information technology. Animation is very powerful in sensory terms. The human eye is organized to respond strongly to changes in the visual field. Animation attracts the eye's attention.

Finally, animation increases the energy level of the program, consequently increasing the user's emotional involvement. Many program failures are due to user failures, which in turn can be traced to user inattentiveness. If you want the user's attention, you've got to jump up and down.

Sound

Graphics images must be looked at to have effect. Sound can reach a user's ears even when the user is not paying direct attention to the video display. Sound therefore has great value as an annunciator or warning cue. A wide variety of beeps, tones, and grunts can be used to signal feedback to the user. Correct actions can be answered with a pleasant bell tone. Warning conditions can be noted with a honk.

Sound has a second use: providing realistic sound effects. Quality sound effects greatly add to the impact of a program because the sound provides a second channel of information flow that is effective even when the user is overlooking the visual component of the program.

Sound is ill-suited for conveying straight factual information; most people do not have the aural acuity to distinguish fine tone differences. Sound is much more effective for conveying emotional states or responses. People associate many sounds with emotional states. A descending sequence of notes implies deteriorating circumstances. An explosive sound denotes destruction. A fanfare announces an important arrival. Certain note sequences from widely recognized popular songs are immediately associated with particular feelings. For example, in *Energy Czar*, a dirge indicates that the user's energy mismanagement has ruined America's energy situation; a fragment of "Happy Days Are Here Again" indicates success.

Input (Human to Computer)

Three input devices are most commonly used with the Atari 400/800 home computer: the keyboard, paddles, and joystick.

The keyboard is easily the most powerful input device available to the designer, with more than 50 direct keystrokes immediately available. Use of the Control and Shift keys more than doubles the number of distinguishable entries possible. The Caps/Lowr and Atari keys extend the expressive range of the keyboard

even further. Thus, with a single keystroke, the user can designate one of 125 commands. A pair of keystrokes can address more than 15,000 selections. Obviously, this device is very expressive; it can easily handle the communications needs of any program. For this reason, the keyboard is the input device of choice among programmers.

While the strengths of the keyboard are undeniable, its weaknesses are seldom recognized. Its first weakness is that few people know how to use it well. Programmers use keyboards heavily in their daily work; consequently, they are fast typists. The average consumer, however, is not too comfortable with a keyboard, which can lead to many wrong keys being pressed. The very existence of all those keys, and the knowledge that one must press the correct key, is itself intimidating to many people.

A second weakness of the keyboard is its indirection. It is very difficult to attach direct meaning to a

keyboard because it has no obvious emotional or sensory significance. The new user has great difficulty relating to it. All work with the keyboard is symbolic, using buttons marked with symbols that are assigned meaning by the circumstances. The nested indirection of this can be most confusing to the beginner. Keyboards also suffer from their natural association with text displays; I have already discussed the weaknesses of text as a medium for information transfer.

Another property of the keyboard that the designer must keep in mind is its digital nature. The keyboard is digital both in selection and in time (i.e., keyboard input is divided into keystrokes, and only one keystroke can be entered at a time). This provides some protection against errors. Because keystroke reading over time is not continuous but digital, the keyboard is not well suited to real-time applications. Since humans are real-time creatures, this is a weakness. The designer must realize

that use of the keyboard will lengthen the distance from real-time interaction with the user.

Paddles

Paddles are the only true analog input devices readily available for the system. As such, they suffer from the standard problem all analog input devices share: the requirement that the user make precise settings to get a result. Their angular resolution is poor, and thermal effects produce slightly fluctuating readings in even an untouched paddle.

The primary value of paddles is twofold. First, they are well suited for choosing values of a one-dimensional variable. People can readily absorb the idea that the paddle sweeps through all values and that pressing the trigger makes the selection known. Second, the user can sweep from one end of the spectrum to the other with a twist of the dial, which makes the entire spectrum of values immediately accessible.

An important factor in the use of paddles is the creation of a closed input/output loop. In most input processes, it is desirable to echo inputs to the screen so that the user can verify the input that was entered. This echoing process creates a closed input/output loop. Information travels from the user to the input device (paddles) to the computer, then back through the video display to the user. Because it is difficult for the user to verify the position to which the paddle has been set, it is essential that the program echo the paddle input.

Any set of inputs that can be meaningfully placed along a linear sequence can be addressed with a paddle. For example, menus can be addressed with a paddle. The sequence is from the top of the menu to the bottom. It is quite possible (but entirely unreasonable) to substitute a paddle for a keyboard. The paddle could sweep through the letters of the alphabet, with the current letter being addressed shown on the screen. Pressing the paddle trigger would then select the letter. While this scheme would not produce any typing speed records, it could be useful for

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children, and the concept can be applied to other selection problems.

Joysticks

Joysticks are the simplest input devices available for the computer. Since they are very sturdy, they can be used in harsh environments. They contain only five switches (one for the red button on the joystick and one for each of the four principal directions of the compass). For this reason, their expressive power is frequently

underestimated. Joysticks, however, are surprisingly useful input devices. When used with a cursor, a joystick can address any point on the screen and can indicate a selection with the red button. With proper screen layout, the joystick can thus provide a wide variety of control functions. I have used a joystick to control a nuclear reactor (in the game *Scram*) and run a war game (in *Eastern Front 1941*).

The key to proper use of the joystick is the realization that the

critical variable is not the selection of a switch, but the duration of time for which the switch is pressed. By controlling how long the switch is pressed, the user determines how far the cursor moves. This normally requires a constant-velocity cursor, which introduces a difficult trade-off. If the cursor moves too fast, the user will have difficulty positioning it on the item of choice. If the cursor moves too slowly, the user will become impatient waiting for it to traverse long screen distances. One solution to this problem is an accelerating cursor. If the cursor starts moving slowly and accelerates if it remains in motion past a set length of time, the user can have both fine positioning and high speed.

The real value of the joystick is its high tactility. The joystick involves the user in inputs in a direct and sensory way. The tactility of the keyboard is not emotionally significant. A joystick makes sense—push up to go up, push down to go down. If the cursor reflects this on the screen, the entire input process makes much more sense to the user.

Joysticks do have their limitations. Although it is possible to press the joystick in a diagonal direction and get a correct reading of the direction, the directions are not distinct enough to allow diagonal entries as separate commands. Just as some words (e.g., "library," "February") are difficult to enunciate clearly, some diagonal orders are difficult to enter distinctly. Thus, diagonal values should be avoided unless they are used in the pure geometrical sense: up on the joystick means up, right means right, and diagonally means diagonally.

Recap

We have discussed a number of features and devices that, taken together, constitute the elements of a language for interaction between the computer and the user. The features are:

- shapes
- color
- animation
- sound

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The devices are:

- keyboard
- paddles
- joystick

How do we assemble all these elements into an effective language? To do so, we must first determine the major traits we expect of a good language:

- completeness
- directness
- closure

Completeness

The language must completely express all the ideas that need to be communicated between the computer and the user, but it need not express ideas internal to either thinker's thought processes. For example, the language used in Star Raiders must express all concepts related to the control of the vessel and the combat situation. It need not express the

player's anxiety or the flight-path intentions of the Zylon enemy ships. These concepts, while germane to the entire game function, need not be communicated between user and computer.

Completeness is an obvious function of any language, one that all programmers recognize intuitively. Problems with completeness most often arise when the programmer must add functions to the program, functions that cannot be supported by the language the programmer has created. This can be quite exasperating, for in many cases the additional functions are easily implemented in the program itself. The limiting factor is always the difficulty of adding new expressions to the language used between the human and the computer.

Directness

Any new language is difficult to learn. Nobody has time to waste in learning an unnecessarily florid language. The language a program-

mer creates must be direct and to the point. It must rely as much as possible on communications conventions that the user already knows and must be emotionally direct and obvious. For example, a CTRL-X keystroke is obscure. What does it mean? Perhaps it means that something should be destroyed; X implies elimination or negation. Perhaps it implies that something should be examined, expunged, exhumed, or something similar. If none of these possibilities is indeed the case, the command is unacceptably indirect. Keyboards are notorious for creating this kind of problem.

Closure

Closure is the aspect of communications design that causes the greatest problems. The concept is best explained with an analogy. The user is at point A and wishes to use the program to get to point B. A poorly designed program is like a tightrope stretched between points A and B. The user who knows exactly what to

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do and performs perfectly will succeed. More likely, he or she will slip and fall. Some programs try to help by providing a manual or internal warnings that tell the user what to do and what not to do. These are analogous to signs along the tightrope advising "BE CAREFUL" and "DON'T FALL." I have seen several programs that place signs underneath the tightrope, so that the user can at least see why the fall is happening. A somewhat better class of programs provides masks against illegal entries, equivalent to guardrails alongside the tightrope. These do help, but they must be well constructed to ensure that the user does not thwart them. Some programs have nasty messages that bark at the errant user, warning against making certain entries. These are analogous to scowling monitors in school corridors, and they are useful only for making an adult feel like a child. The ideal program is like a tunnel bored through solid rock. There is but one path, the path

leading to success.

The essence of closure is the narrowing of options, the elimination of possibilities, and the placement of rock-solid walls around the user. Good design is not an accumulative process of piling lots of features onto a basic architecture; good design requires the programmer to strip away minor features, petty options, and general trivia.

While the strengths of the keyboard are undeniable, its weaknesses are seldom recognized.

This contention clashes with the values of many programmers, who crave complete freedom to exercise power over the computer. Their most common complaint against a program is that it somehow restricts their

options. Thus, deliberate advocacy of closure is met with shocked incredulity. Why would anyone be so foolish as to restrict the power of this wonderful tool?

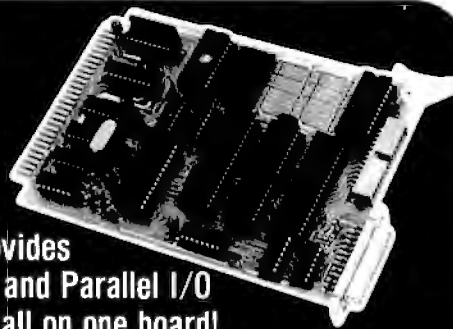
The answer lies in the difference between the consumer and the programmer. The programmer's life is devoted to the computer; the consumer is a casual acquaintance at best. The programmer uses the computer so heavily that it is cost-effective to take the time to learn to use a more powerful tool. Since the consumer does not have such time to lavish on the machine, a simple, quick operation is required. The fine points that a programmer dotes on are not important to the user; nor are the bells and whistles cherished by programmers. As a programmer, you may not share or approve of the consumer's values. But if you want to maintain your livelihood, you had better cater to them.

Closure is obtained by creating inputs and outputs that do not admit illegal values. This is extremely difficult to do with a keyboard, for a keyboard always allows more entries than any real program would need. This provides an excellent argument against the use of the keyboard. A joystick is much better because you can do so little with it, making it easier to conceptually exclude bad inputs. The ideal is achieved when all necessary options are expressible with the joystick and no further options will fit. In this case, the user cannot make a bad entry because it doesn't exist. More important, as in the language Newspeak in George Orwell's *Nineteen Eighty-four*, the user cannot even conceive bad thoughts because no words (inputs) for them even exist.

Closure is much more than masking out bad inputs. Masking makes bad inputs conceivable and expressible, but not functional. For example, a keyboard might be used with the "M" key disabled because it is meaningless. The user can still see the key, can imagine pressing it, and can wonder what would happen if it was pressed—all wasted effort. The user can waste even more time by pressing

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it and wondering why nothing happened. The waste is compounded by the programmer imagining the user doing all these wasteful things and putting in code to stop the symptoms without eliminating the disease. Why are these people wasting so much time over a button that doesn't do anything in the first place? A properly closed input structure avoids all these problems because it uses an input device that can express only the entries necessary to run the program—and nothing more. The user can't waste time dealing with something that isn't there, and the programmer can't waste time masking out bad inputs that can't be entered.

Closure provides an important feature for the beginning user: security. Imagine the naive user peering down at an army of deadly keys, each one laden with the potential for triggering World War III, or at least destroying the computer. A properly

closed program offers fewer choices and fewer lurking disasters. Less perceived opportunity for failure generates confidence that, in turn, generates more fluent use of the program.

The designer must carefully weigh the capabilities of the machine and the needs of the user.

Many advantages accrue to the programmer when closure is properly applied. Code is tighter and runs faster because there need be no input error checking. Program structure is simpler because there are fewer logical tests and branches. Less testing is needed because there are fewer input conditions to test.

The primary problem with closure is the design effort that must be expended to achieve good closure. The entire relationship between the user and the program must be carefully analyzed to determine the minimum vocabulary necessary for the two to communicate. Numerous schemes of communication must be examined and discarded before the true minimum scheme is found. In the process, many bells and whistles that the programmer wanted to add will be eliminated. An objective viewpoint will conclude that the bells and whistles are more clutter than chrome.

Conclusions

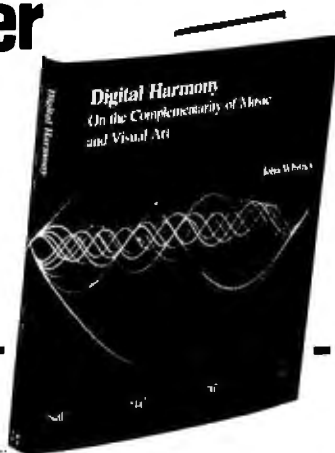
The design of the language of communication between the user and the program will be the most difficult part of the design process in consumer software. The designer must carefully weigh the capabilities of the machine and the needs of the user. The information that flows between the two sentient beings must be precisely defined. The language is then designed to maximize the clarity (not the quantity) of information flowing to the user while minimizing the effort the user must expend to communicate with the computer. The language must utilize the machine's features and devices effectively while maintaining its own completeness, directness, and closure.

The result will be a program that eliminates mental distance between the user and the computer. The two thinking beings achieve a mental resonance, an intellectual communion. ■

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The Atari Tutorial ends this month with Chris Crawford's essay on human engineering. We at BYTE have been proud to present it to you, and we want to thank Chris Crawford, Bob Fraser, Kathleen Pitta, and Lane Winner for making it possible.

In the past year, the Atari 400/800 computer has become one of the most popular microcomputers. We plan to continue coverage of the Atari in BYTE, and we are very interested in seeing Atari-related articles from you. . . G. W.

The End of 8-Bit Epoch?

Dear Steve,

I'm thinking of getting a microcomputer so that I can write and sell software. However, since IBM has introduced a 16-bit computer, and I had planned to buy an 8-bit Atari 800, I fear that Atari will follow IBM's lead and replace the 800 with a 16-bit computer after I make my purchase. Then I will own an outdated piece of junk. Do you know if Atari is about to convert to 16 bits?

Harry Sices
Hanover, NH

The future trend of computers will certainly include 16-bit and possibly 32-bit machines, but 8-bit machines will definitely not become "outdated pieces of junk." Look to the bright side of 8-bit machines:

- they have been around for several years
- virtually every home computer is an 8-bit machine
- documentation and software abound for these machines

•at least a half million of them are in use

I doubt that you will see 16-bit computers taking over in the near future, so don't fear buying an 8-bit machine. If your goal is to write and sell software, you will certainly have a larger market with the 8-bit machines. Atari even offers the part-time programmer an advantage, since it will help market good software written for its machine.

At this time, I am not aware of any effort by Atari to market a 16-bit machine, but I assume that Atari may eventually feel market pressures to do so. . . . Steve

Computer-Controlled Security System for Your Home," Part 1, January 1979 BYTE, page 56; Part 2, February 1979 BYTE, page 162; Part 3, March 1979 BYTE, page 150.) What devices do you use?

I'm planning on installing two sensors about 10 feet apart mounted on split-rail fence posts. (That way I can sense the direction of movement.) I will have to run at least 250 feet of wire from the house to the sensors. The distance from the source to the sensor across the driveway is about 12 feet. Any ideas that you have would be greatly appreciated.

Charles Finn
Fayetteville, GA

Sensing Motions

Dear Steve,

I'm interested in adding sensors to my driveway and connecting them to my security system. In the articles that you've written on security systems, you mentioned that you were using sensors in your driveway. (See "Build a

I have tried a number of different sensors in my driveway, and I found that the most reliable is a microwave motion-detector combined with an ultrasonic beam that goes directly across the driveway.

I have a fairly long, U-shaped driveway. The ultrasonic transmitter (see

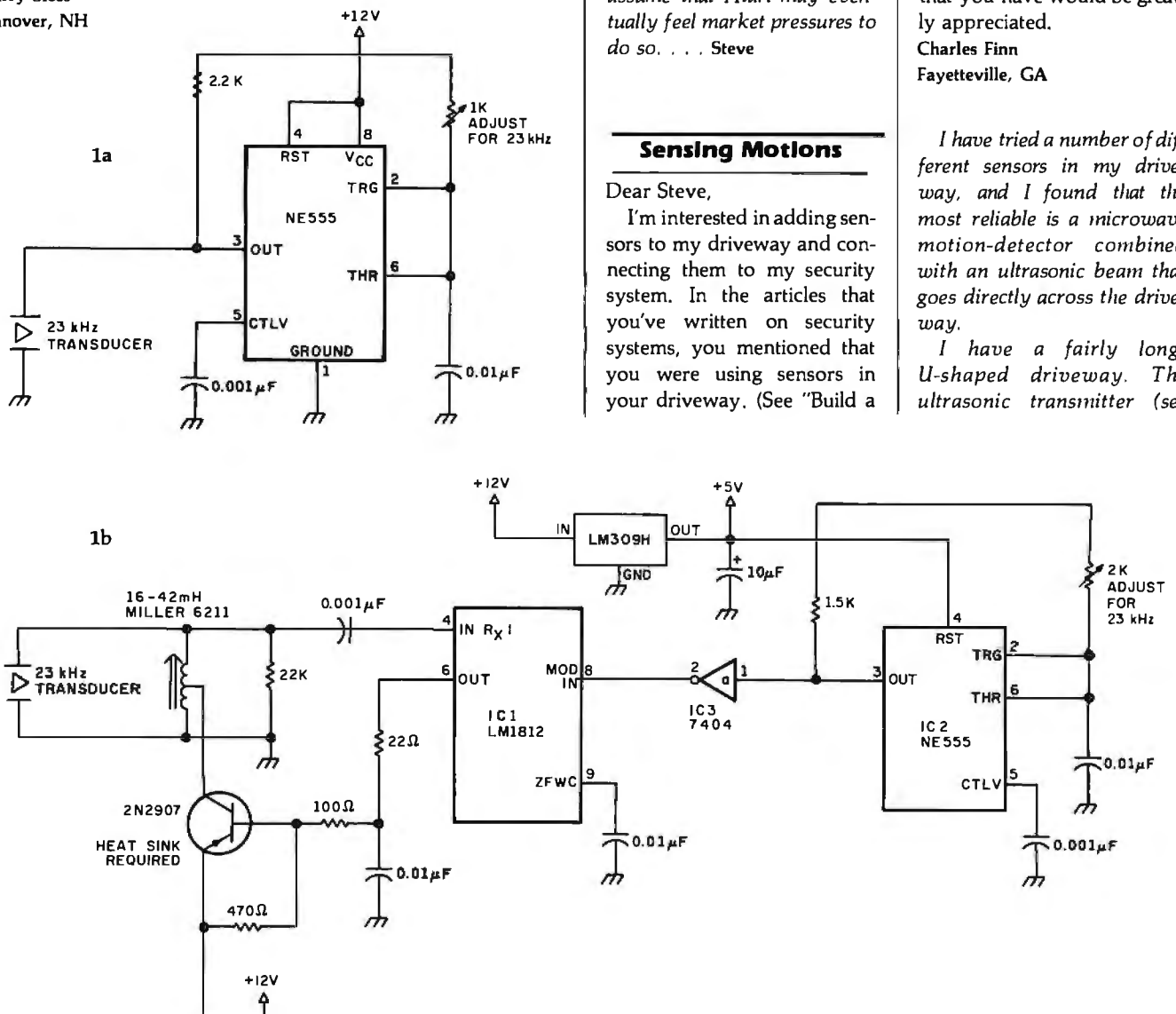


Figure 1: Ultrasonic transmitters.

Software Received

Apple

Apple Flasher, a utility program for developing high-resolution graphics for the Apple II. Floppy disk, \$34.50. Crow Ridge Associates Inc., POB 90, New Scotland, NY 12127.

Audex, a collection of utility programs to create, edit, and play sounds for the Apple II. Floppy disk, \$29.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Deadline, an interactive role-playing program for the Apple II. Floppy disk, \$49.95. Infocom, 55 Wheeler St., Cambridge, MA 02138.

DOS File Exchange, a telecommunications software package for the Apple II Plus. Floppy disk, \$45. Arrow Micro Software, 11 Kingsford, Kanata, Ontario, K2K 1T5, Canada.

8080/8085 Assembler, a cross-assembler for the Apple II. Floppy disk, \$39. A.M.I. Electronics, 851 Richmond Rd., Lyndhurst, OH 44124.

Estate Tax Plan, a program package to solve complex estate tax-planning problems for the Apple II. Floppy disk, \$695. Aardvark Software Inc., 783 North Water St., Milwaukee, WI 53202.

GraFORTH, a graphics programming language for the Apple II. Floppy disk, \$75. Insoft, Suite 202B, 10175 Southwest Barbur Blvd., Portland, OR 97219.

The Graphics Magician, a graphics development package for the Apple II. Floppy disk, \$59.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

Hungry Boy, an arcade-type game for the Apple II.

Floppy disk, \$24.95. Cosmos Astar International Co., 5676 Francis Ave., Chino, CA 91710.

IFR Flight Simulator, an instruments-only, air-flight simulator for the Apple II. Floppy disk, \$50. Programmers Software Exchange, POB 199, Cabot, AR 72023.

Kabul Spy, an adventure-type game for the Apple II Plus. Floppy disk, \$34.95. Sirius Software Inc. (see address above).

Micro-Window, a 6502 machine-language training and development program for the Apple II Plus. Floppy disk, \$120. Window Research, Suite #218, 13452-A Northeast 175th, Woodinville, WA 98072.

Minotaur, an arcade-type game based on the ancient Greek myth for the Apple II. Floppy disk, \$34.95. Sirius Software Inc. (see address above).

Payfive, a flexible payroll and accounting system for the Apple II Plus. Floppy disk, \$149.95. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Photar, an arcade-type game for the Apple II. Floppy disk, \$29.95. Softape, 10432 Burbank Blvd., North Hollywood, CA 91601.

Routeplanner, a trip-planning program for deliveries or salespersons for the Apple II. Floppy disk, \$149. Columbia Software, 5461 Marsh Hawk Way, POB 2235, Columbia, MD 21045.

Snack Attack, an arcade-type game for the Apple II. Floppy disk, \$29.95. Data-most, 19273 Kenya St., Northridge, CA 91326.

Star Blaster, an arcade-type game for the Apple II. Floppy disk, \$29.95. Piccadilly Software Inc., 89 Summit Ave., Summit, NJ 07901.

Star Blazer, an arcade-type game for the Apple II. Floppy disk, \$31.95. Broderbund

Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Suicide, an arcade-type game for the Apple II. Floppy disk, \$29.95. Piccadilly Software Inc. (see address above).

Atari

Baccarat, a card game for one to three players for the Atari 800. Floppy disk, \$22.95. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Backgammon 2.0, a one- or two-player version of the board game for the Atari 800. Floppy disk, \$18.95. Dynacomp Inc. (see address above).

Caverns of Mars, an arcade-type game for the Atari 400/800. Floppy disk, \$39.95. Atari, 1265 Borregas Ave., Sunnyvale, CA 94086.

Chicken, an arcade-type game for the Atari 400/800. Cassette or floppy disk, \$29.95. Synapse Software, 820 Coventry Rd., Kensington, CA 94707.

Deluxe Invaders, an arcade-type game for the Atari 400/800. Floppy disk, \$34.95. Roklan Corp., 10600 West Higgins Rd., Rosemont, IL 60018.

Escape from Volantium, an arcade-type game for the Atari 800. Floppy disk, \$19.95. Dynacomp Inc. (see address above).

The Family Budget, a personal financial-management package for the Atari 800. Floppy disk, \$34.95. Dynacomp Inc. (see address above).

The Graphics Machine, a graphics utility program for the Atari 800. Floppy disk, \$19.95. Santa Cruz Educational Software, 5425 Jigger Dr., Soquel, CA 95073.

Go Fish, the children's game for one player for the Atari 800. Floppy disk, \$18.95. Dynacomp Inc. (see address above).

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Lil' Men from Mars, an arcade-type game for the Atari 800. Floppy disk, \$23.95. Dynacomp Inc. (see address above).

Mailmaster, a mailing-list utility program for the Atari 800. Floppy disk, \$39.95. Dynacomp Inc. (see address above).

Protector, an arcade-type game for the Atari 400/800. Floppy disk, \$29.95. Synapse Software (see address above).

Stockaid, a stock performance-analysis program for the Atari 800. Floppy disk, \$29.95. Dynacomp Inc. (see address above).

Teacher's Aide, a tutorial package covering elementary mathematics for the Atari 800. Floppy disk, \$17.95. Dynacomp Inc. (see address above).

Tricky Tutorials, a six-lesson package covering advanced programming for the Atari 400/800. Floppy disk, \$99.95. Santa Cruz Educational Software (see address above).

Turnkey and Menu, an auto-execute utility for BASIC programs for the Atari 800. Floppy disk, \$17.95. Dynacomp Inc. (see address above).

CP/M

68000 Disassembler, a disassembler for 68000 systems based on the Motorola Exor-mac. 8-inch floppy disk, \$200. Norsoft Consultants, Veungsdalveien 1, 3600 Kongsberg, Oslo, Norway.

The Programmer's Apprentice, a program-development system for creating MBASIC source programs for CP/M. 8-inch floppy disk, \$800. The Software Group, 10471 South Brookhurst St., Anaheim, CA 92804.

PET

Genesis, a program to develop computer-assisted in-

structions for the PET/CBM. Cassette, \$30. Greenwood Software, 1214 Washington, The Dalles, OR 97058.

Phantom Fighter, an arcade-type game for the PET/CBM. Cassette, \$14.95. Magic Carpet, POB 35115, Phoenix, AZ 85069.

Pharmacology Update, a tutorial package for health-care professionals for the PET/CBM. Floppy disk, \$149.95. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Star Voyager, an arcade-type game for the PET/CBM. Cassette, \$9.95; floppy disk, \$12.95. Paul Yates, 1955 Shady Brook Lane, Morgan Hill, CA 95037.

Vortex, an arcade-type game for the PET/CBM. Cassette, \$14.95. Magic Carpet (see address above).

TI-99/4

Space Spiders, an arcade-type game for the TI-99/4. Cassette, \$9. Glo-Data, POB 374, Stony Point, NY 10980.

Video Titles I, a program to produce customized titles for video recordings for the TI-99/4A. Floppy disk, \$24.95. J & KH Software, 2820 South Abingdon St., Arlington, VA 22206.

TRS-80

BASIC Faster and Better Demonstration, a software library of demonstration programs for use with the book *Faster and Better & Other Mysteries* for the TRS-80 Models I and III. Floppy disk, \$19.95. IJG Inc., 1260 West Foothill Blvd., Upland, CA 91786.

BASIC Faster and Better Library, a software library of routines for use with the book *Faster and Better & Other Mysteries* for the TRS-80 Models I and III. Floppy disk, \$19.95. IJG Inc. (see address above).

Battle Trek, a Star Trek-type game for the TRS-80 Models I and III. Cassette, \$29.95. Voyager Software, POB 15-518, San Francisco, CA 94115.

Ghost Gobbler, an arcade-type game for the TRS-80 Color Computer. Cassette,

\$21.95. Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466.

Gradebook 2.0, a disk-based gradebook program for the TRS-80 Models I and III. Cassette, \$34.95. MM Computer Club, 333 75th St., Downers Grove, IL 60516. ■

This is a list of software packages that have been received by BYTE Publications during the past month. The list is correct to the best of our knowledge, but it is not meant to be a full description of the product or the forms in which the product is available. In particular, some packages may be sold for several machines or in both cassette and floppy-disk format; the product listed here is the version received by BYTE Publications.

This is an all-inclusive list that makes no comment on the quality or usefulness of the software listed. We regret that we cannot review every software package we receive. Instead, this list is meant to be a monthly acknowledgment of these packages and the companies that sent them. All software received is considered to be on loan to BYTE and is returned to the manufacturer after a set period of time. Companies sending software packages should be sure to include the list price of the packages and (where appropriate) the alternate forms in which they are available.

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Conducted by Steve Clarcla

Computer-Controlled Irrigation

Dear Steve,

I'm about to dive into building a Z8-BASIC Microcomputer, mainly as an irrigation control for my almond ranch. (See "Build a Z8-Based Control Computer with BASIC," Part 1, July 1981 BYTE, page 38 and Part 2, August 1981 BYTE, page 50.) Before I proceed, however, I would appreciate knowing if the Z8 would operate off the 25-pin parallel 4-bit interface bus on a Heath ID-4001 Digital Weather Computer. The program would use inputs to control an assortment of mechanically stepped irrigation valves.

I have talked with Heath about its rain gauge, but I find it expensive because it duplicates the Weather Computer in many respects. A moisture-gauge input to the Z8 would be preferable, and the 25-pin bus has four extra pins plus ground, so I am thinking about combining the inputs into a single port.

A.A. Boon-Hartsinck
Burbank, CA

The concept of using the Z8-BASIC Microcomputer as an irrigation control is an excellent application. The Z8 has enough ports to connect with moisture gauges and data from the Heath ID-4001 Weather Computer (or any other computer, for that matter). Information on an A/D (analog-to-digital) converter appeared in my August 1981 BYTE article.

The February 1982 BYTE contained an article on interfacing the Z8-BASIC Microcomputer to wind-speed, wind-direction, and baromet-

ric-pressure instruments (à la Heath), as well as to a voice synthesizer. (See "Build a Computerized Weather Station," page 38.) . . . Steve

ZX81 for Home Control

Dear Steve,

In one of your Circuit Cellar articles, you discussed methods of controlling the BSR X-10 command console with a dedicated microprocessor. (See "Computerize a Home," January 1980 BYTE, page 28.) In another, you dealt with a home-security system using a computer for control. (See "Build a Computer-Controlled Security System for Your Home," Part 1, January 1979 BYTE, page 56; Part 2, February 1979 BYTE, page 162; Part 3, March 1979 BYTE, page 150.) Can the Sinclair ZX81 be used for either of these purposes, and, if so, how much modification would be required? What would be the total memory requirements, additional I/O ports, and so on to set up such a system? Also, would this system work with a single- or dual-cassette configuration?

J.W. Rankin Jr.
Memphis, TN

The Sinclair ZX81 has full expansion capabilities because the system buses are brought out to its rear connector and are available for many interfacing applications, including a BSR X-10 controller. It is advisable to buffer the output lines if more than one integrated circuit is to be driven. The unit can be mapped wherever there is free memory. The ZX81 can be used to control a single- or dual-cassette drive.

If you want additional I/O capabilities, an expansion unit can be built that would provide buffered address and data lines, serial and parallel printer ports, and any other ports as desired. The COMM-80 (see "I/O Expansion for the TRS-80," June 1980 BYTE, page 42) will satisfy most of these needs and can be adapted to the ZX81 without great difficulty.

. . . Steve

Current Overloads

Dear Steve,

I have an early model Radio Shack TRS-80 Color Computer with a 32K-byte memory upgrade from Spectral Associates. After about four hours of continuous use, the computer overheats and ceases to function. I have installed a fan, which seems to help a lot, but I feel there's something else I should do. The on/off switch turns off the power from the supply transformer to the computer, but does not disconnect the transformer from the AC line. Should it be unplugged when not in use?

Roland C. Wong
West Covina, CA

I spoke with Radio Shack about your overheating problem. Its technicians concluded that the problem is due to the added memory. Let me explain: while the average current requirements of 4116-type memory are low, the pulse currents are high. You may be causing the power supply to enter a current-limit condition. You can verify this hypothesis by carefully removing the add-on

memory and noting if the problem vanishes.

It appears that there is just a little too much current being drawn (and heat generated) by the extra memory. The fact that the fan eliminates the problem and that the problem takes four hours to occur substantiates this. The simplest, and cheapest, solution is to live with the fan (just keep your tapes away from the motor).

It is true that the transformer is left "live" when the unit is shut off. While this will not hurt anything, the transformer will draw a small amount of current; in the interest of energy conservation, unplug it. . . . Steve

Redefining Atari Characters

Dear Steve,

I want to redefine the characters on my Atari 800. Do you have any hints on how to do this, or do you know where I can find the software? The number of characters I need is between 48 and 100.

Russ Burroughs
Edmond, OK

Compute! magazine (POB 5406, Greensboro, NC 27403, (919) 275-9809) recently carried two articles that should answer your questions about redefining characters on the Atari 800. The first, "Character Generation on the Atari," by Charles Brannon, appeared in the February 1981 issue (page 76) and the second, "Designing Your Own Atari Character Sets," by Craig Patchett, appeared in the March 1981 issue (page 72). . . . Steve

Ask BYTE

Conducted by Steve Ciarcia

Tips on Homebrewing

Dear Steve,

I have started doing some research for my next project: building my own microcomputer and am interested in your book *Build Your Own Z80 Computer*. I have read several similar books and am getting ready to start design and construction; however, I have a number of questions:

- If I wish to incorporate a BASIC interpreter in my computer (not tiny BASIC but something akin to TRS-80 Level II, etc.), I presumably need to purchase a ROM (read-only memory) containing this program. Where do I find one? I haven't seen them advertised in the mail-order places in the popular magazines.
- Along the same line, where can I buy an interpreter for assembly language so that I can use mnemonic op codes instead of hexadecimal codes for programming?
- Is it possible for a home-built machine to be software-compatible with, say, the Radio Shack TRS-80 Model I? In other words, is it realistic to try and build a machine that will be able to load and run tapes or disks made for the TRS-80?
- Are there many different BASIC interpreters from which to choose? If so, which do you consider the best from a homebrewer's point of view?

David J. Abineri
Lakewood, OH

Microsoft BASIC is the de facto standard among BASIC interpreters and is the most popular BASIC in use today. Netronics Research & Development Ltd. (333 Litchfield

Rd., New Milford, CT 06776, (800) 243-7428; in Connecticut, (203) 354-9375) markets an 8K-byte Microsoft BASIC for the Intel 8085 microprocessor that you might want to look into. A cassette version is available for \$64.95 postpaid, and a ROM version is available for \$99.95, plus a \$2 shipping charge. The 8085 is 100% software-compatible with the 8080A and the Z80 (but it does not have all of the Z80 instructions).

For programming in assembly language, you need an assembler, not an interpreter. An assembler allows you to type in the instruction-set mnemonics and specify the program's start address. It then will "assemble" machine language starting at the specified address. Unfortunately, most of the assemblers sold today are geared toward a particular computer. However, I know an excellent book that provides a detailed explanation and complete listing of an assembler for an 8080-based system. It's called TEA: An 8080/8085 Co-Resident Editor/Assembler by Christopher A. Titus. It's published by Howard W. Sams & Company (4300 West 62nd St., POB 7092, Indianapolis, IN 46206, (800) 428-3696; in Indiana, (317) 298-5400) and sells for \$10.95.

For a home-built machine to be software-compatible with the TRS-80, it would need the TRS-80 operating system and TRS-80 Level II BASIC. It is not realistic to try to build a TRS-80-compatible machine from scratch.

Rather than try to copy the TRS-80, I would suggest that, if you wish to build a Z80 computer, build it along the lines of my ZAP computer. Make it S-100-bus-compat-

ible and add some memory and a floppy-disk controller. You can use CP/M (a disk operating system that can run a good Microsoft disk BASIC called BASIC-80) and you will have an unlimited amount of good software available.

The only real problem in custom building your own computer is that you are not software-compatible with anyone and you are constantly "reinventing the wheel" every time you write a program. . . . Steve

Where Does the BASIC Go?

Dear Steve,

I don't know much about computers yet, but I read or heard somewhere that if you wanted to use Pascal or any other language instead of the BASIC that comes with a certain system, you would replace the BASIC with Pascal in the ROM (read-only memory). Would I still have the BASIC in ROM or not? Can you explain it to me?

Thanks.

Keith McCreery
Portage, MI

Using Pascal in a computer that has BASIC in ROM does not affect the BASIC in any way. Pascal is just loaded into user memory. Normally, when another language is used, additional user memory is mapped into the memory-address space used by the ROM BASIC. In this way, the full addressing capability of the microprocessor can be used.

For example, in the Apple II computer, which has BASIC in ROM, supplementary languages are employed through the use of a "lan-

guage card." This provides an additional 16K bytes of memory in place of the BASIC ROM when Pascal is used. The ROM BASIC is still in the computer, but it's bypassed. . . . Steve

Disturbing Line Disturbances

Dear Steve,

I own an Atari 800 that has been sent for repairs three times. I use it with an RCA XL-100 TV, which occasionally loses its screen or flickers for a second when the furnace switches on or off. However, the Atari does not "crash" during the display disturbance. Should I be concerned about the possibility of voltage spikes? I've heard that they can damage the internal parts of a computer, but can they damage a computer when it's off? What should I look for in a power-line protector? The literature from manufacturers seems inadequate.

Walter M. Lee
Olney, MD

The symptoms you describe suggest that you are experiencing a voltage drop as well as possible spikes. Many devices on the market protect against voltage transients by clipping the peaks, thereby keeping them in a safe range, but such devices will not prevent the line voltage from dropping to the point where the computer memory becomes erratic.

From the fact that your Atari 800 does not "crash" during these disturbances, I would suggest a device to clip the transients. This will protect your computer from damage. These units are usually MOVs (metal-oxide

varistors) and are rated by their energy absorption, usually in joules. Choose the largest one that you can find.

If the voltage spikes do not exceed the voltage-breakdown rating of the computer's plug transformer, there is little harm in leaving the computer plugged in after it is turned off. With the transient suppressor in the line, this problem vanishes. . . . Steve

Always Correct Clock

Dear Steve,

Some time ago I saw Don Lancaster's *TTL Cookbook* and became very interested in the "always correct clock" he talked about. I have tried to

find the *Popular Electronics* issues he refers to but have not been able to do so (*Popular Electronics* does not have back issues that old). What I want to do is build that clock and bring the time value to a series of ports that connect with my S-100 system. With this approach, the clock will be correct so long as there is power for the computer. Any information you can supply would be helpful.

Tim R. Norton
Richardson, TX

The articles that Don Lancaster referred to were in the July 1972 and July 1973 issues of *Radio-Electronics*, not *Popular Electronics*. What he also neglected to mention is

the complexity of the receiver necessary to receive and decode the information broadcast at 60 kHz from station WWVB in Boulder, Colorado.

Many S-100 clock boards on the market feature quartz crystals for their timing and should be accurate to within a few seconds a month. This is more than adequate for almost all conceivable timing applications. Some even have onboard battery backup to maintain their accuracy when the computer is shut off. The ready availability and moderate cost of these boards makes them the obvious choice.

For further information, see my article "Everyone Can Know the Real Time" (May 1982 *BYTE*, page 34). . . . Steve

Z8-based Voice-Recognition System

Dear Steve,

I'm working on a voice-recognition system using the Zilog Z8 microprocessor. I need advice on interfacing the Z8 board with an inexpensive speech recognizer that handles 32 words.

I'm a rank beginner.

Robert J. Marek
Waltham, MA

Interfacing a voice-recognition system to the Z8 is not difficult because there are sufficient I/O ports for the hardware portion of it. The tiny BASIC may not be sophisticated enough, so you may have to use machine language.

Since its initial presentation in the July and August 1981 *BYTEs* (see "Build a Z8-Based Control Computer with BASIC," Part 1, July, page 38; Part 2, August, page 50), many accessories have become available for the

Z8-BASIC Microcomputer from The Micromint (917 Midway, Woodmere, NY 11598, (800) 645-3476; in New York, (516) 374-6793). In addition to cross assemblers that run on TRS-80 and CP/M systems, The Micromint has a memory, parallel I/O, and cassette-interface expansion board; a motherboard; and an EPROM (erasable programmable read-only memory) programmer. Other peripherals are in the works.

An excellent article by James R. Boddie, "Speech Recognition for a Personal Computer System," appeared in the July 1977 *BYTE* (see page 64). You can also read "An Extremely Low-Cost Voice Response System" by James C. Anderson (February 1981 *BYTE*, page 36), "Speech Recognition: Turning Theory to Practice" by George R. Doddington and Thomas B. Schalk (*IEEE Spectrum*, September 1981, page 26), and my article "Use Voice Prints to Analyze Speech" (March 1982 *BYTE*, page 50). With help from these articles, you should be able to write the necessary software. . . . Steve ■

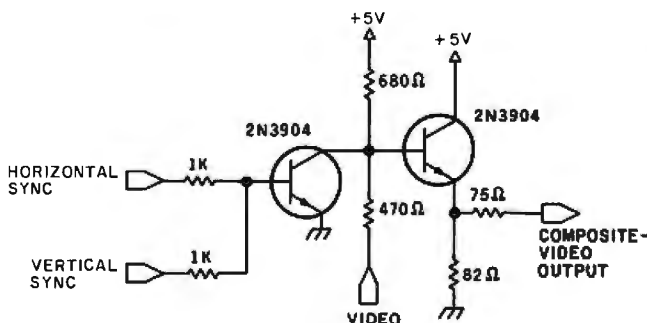


Figure 1

Composite Video from PETs

Dear Steve,

I own a Commodore PET 2001 computer with the old ROM (read-only memory) set. I recently purchased a Sanyo DM5112CX video monitor that I intend to use along with the PET's 9-inch monitor. Are you aware of a simple circuit that would take the signals from the PET and give me the composite-video signal that I need for the Sanyo? From the PET, I can easily get the following signals:

horizontal drive (TTL)
vertical drive (TTL)
video (TTL)

I can also get a +5-volt signal from the main logic board.

David Rene Anatol
Philadelphia, PA

Obtaining a composite-video signal from the horizontal sync, vertical sync, and video signals from the PET 2001 is very easy. The circuit shown in figure 1 is a video combiner that transforms the three separate inputs into a composite-video output. . . . Steve

In "Ask BYTE," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

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tions on any stock you choose to follow, contains a call value section for puts and calls, and a commission costs estimating feature. For the Apple II and II Plus; floppy disk, \$54. KCR Inc., Micro Statistics Division, POB 727, Sherman, TX 75090.

Sunpas, Sunop, and Tswing, a passive solar-heating analysis package designed for architects and engineers. These programs estimate yearly heating requirements of a passive solar building and perform nodal analysis thermal simulations. For the Apple II Plus; floppy disk, \$700. Solarsoft Inc., POB 124, Snowmass, CO 81654.

Super Stellar Trek, a Star Trek-type game. This is an improved successor to the original Stellar Trek game. For the Apple II; floppy disk, \$34.95. Rainbow Computing Inc., 9719 Reseda Blvd., Northridge, CA 91324.

Threshold, an arcade-type game. You must destroy a large number of alien targets that appear in successive waves with increasing speed. For the Apple II; floppy disk, \$39.95. On-Line Systems (see address above).

Time Zone, an adventure-type game on six floppy disks. As you travel through time, you attempt to save humanity from alien domination. Estimated playing time: one year. For the Apple II; floppy disk, \$99.95. On-Line Systems (see address above).

VC-Loader, a utility program to convert text or print files into DIF files for use with Visicalc, Visiplot, and Visi-trend. For the Apple II Plus; floppy disk, \$65. Micro Decision Systems, POB 1392, Pittsburgh, PA 15219.

Visicaids, Visicalc formatting aids for use with Visicalc files. It allows for variable width columns, long labels, splitting labels, formula printout, and print file reading. For the Apple II Plus; floppy disk, \$44.95. Data

Security Concepts, POB 31044, Des Peres, MO 63131.

Word Handler, a word-processing program that gives you a 66-column display without hardware modifications. It includes all standard word-processing functions such as lowercase, underlining, superscript, and unlimited tabs. All functions are displayed on the screen. For the Apple II; floppy disk, \$199. Silicon Valley Systems Inc., 1625 El Camino Real #4, Belmont, CA 94002.

Zero Gravity Pinball, an arcade-type game. This game simulates pinball as it might be played in zero gravity. For the Apple II; floppy disk, \$29.95. Avant-Garde Creations, POB 30160, Eugene, OR 97403.

Atari

Rear Guard, an arcade-type game (see description above). For the Atari 400 and 800; floppy disk, \$29.95. Adventure International, POB 3435, Longwood, FL 32750.

Ricochet, an arcade-type game (see description above). For the Atari 400 and 800; floppy disk or cassette, \$19.95. Automated Simulations, POB 4247, Mountain View, CA 94040.

CP/M

Accounts Payable, an accounts payable package. For CP/M with RM/COBOL; floppy disk, \$1000. Micro Business Software Inc., Dover Rd., Willow Hill Building, Chichester, NH 03263.

Accounts Receivable, an accounts receivable package. For CP/M with RM/COBOL; floppy disk, \$1000. Micro Business Software Inc. (see address above).

General Ledger, a general ledger package. For CP/M with RM/COBOL; floppy disk, \$1000. Micro Business Software Inc. (see address above).

Order Entry/Billing, this package provides complete order-entry and billing functions including printing credit memos and invoices, receiving transaction entry, editing and posting with edit list and journal, order-entry, and interactive inventory control. Interfaces with other Micro Business Software accounting packages. For CP/M with RM/COBOL; floppy disk, \$1000. Micro Business Software Inc. (see address above).

Perfect Writer, a word-processing program featuring virtual memory architecture that allows editing of documents larger than memory. Includes multiple file display and user-definable commands. For CP/M; 8-inch floppy disk, \$389. Perfect Software Inc., 71 Murray St., New York, NY 10007.

Payroll, a full payroll system for a small business. Handles both hourly and salaried employees, prints checks and check register, payroll and deductions register, and performs all payroll calculations. Interfaces with the Micro Business Software General Ledger package, or it can run as a stand-alone system. For CP/M with RM/COBOL; floppy disk, \$1000. Micro Business Software Inc. (see address above).

Sales Analysis, this program tabulates and prints sales analysis reports according to customer types and volumes, item type, category, and volume. Also analyzes sales force performance. For CP/M with RM/COBOL; floppy disk, \$500. Micro Business Software Inc. (see address above).

UVMAC Z80—Absolute Macro Assembler, this utility uses source files similar to CP/M assembly language. It supports file inclusion, conditional assembly, and listing control, and it produces

.COM files. Includes a non-macro version. For CP/M (Z80); floppy disk, \$29.95. The Software Toolworks, 14478 Glorietta Dr., Sherman Oaks, CA 91423.

Exidy Sorcerer

Duel: A Dogfight in Space, an arcade-type game for two players. Written in machine-language, this high-resolution graphics game features two ships that accelerate, rotate, and fire weapons. For the Exidy Sorcerer; cassette, \$20. Dayspring Computer Enterprises, POB 1910, Eugene, OR 97440.

Heath

Recipe-Master Version 1.01, a program to index and select recipes from a master file. It lets you display or print a recipe, create a sorted index, search for a specific recipe, and scan titles for specific keywords. For the Heath H-8 and H-89; floppy disk, \$19.95. Interactive Micro Systems, POB 21007, Columbus, OH 43221.

IBM Personal Computer

Diskette Library Management System, a disk-library cataloging system that creates a file of the programs on each of your disks. Files can be updated and edited at any time. For the IBM Personal Computer; floppy disk, \$100. Software Architects Inc., 27B Griffith Lane, Ridgefield, CT 06877.

Floppy-Disk Librarian, a disk-library cataloging system. This interactive set of programs maintains files and shows the location of each program on any particular disk. Requires PC DOS. For the IBM Personal Computer; floppy disk, \$39.95. Little Bit, 469 Edgewood Ave., New Haven, CT 06511.

The Programmer, a program generator. Designed to run under BASICA, the Programmer allows you to create a program by selecting func-

What's New?

member, you receive annually four packages containing floppy disk-based software, updated commodity database, a detailed instruction book written in nontechnical language, complete documentation and reports, and graphics software that allows you to see buy-and-sell calls with daily open, high, low, and close. Opportunities to purchase technical trade books are also offered.

The IMM membership fee is \$995 for the first year and \$350 for the second year. Members receive \$100 for each program donated to IMM. Complete details are available from George Arndt, CTA, Investors' Micro Messenger, POB 319, Harvard, MA 01451, (617) 456-8830. Circle 573 on inquiry card.

Atari BASIC Tutorials

Santa Cruz Educational Software's Tricky Tutorials are designed to help sharpen your Atari BASIC programming skills. Each tutorial in the six-disk package consists of a discussion in plain language and examples already entered and running. The topics covered are Display Lists, Horizontal and Vertical Scrolling, Page Flipping, Basics of Animation, Player Missile Graphics, and Sounds and Music.

Tricky Tutorials are available on tape or disk in a single package for \$99.95 plus \$3 for shipping and handling. They require

16K- to 32K-byte tape-based Ataris or 24K- or 32K-byte Ataris with disk drives. Order Tricky Tutorials from Santa Cruz Educational Software, 5425 Jigger Dr., Soquel, CA 95073, (408) 476-4901. Circle 574 on inquiry card.

Strategy Game

Automated Simulations' Ricochet is a strategy game combined with fast-action graphics. It can be played with another player or any of four different computer opponents. Here's how it works: players maneuver blocks to set up a shot at the opposing goal and to protect their own goal. Each contestant has two launchers to fire. Shots ricochet off the blocks, earning points for each hit plus bonus points for hitting the opponent's goal. Before victory can be claimed, a player must win two of three (or three of five) games.

Ricochet is available on cassette for 16K-byte Atari 400/800s equipped with the BASIC ROM (read-only memory) cartridge and 16K-byte Level II TRS-80s. On disk, the game can be enjoyed on 32K-byte Atari 400/800s, 32K TRS-80s with the TRSDOS operating system, and 48K-byte Apples with Applesoft in ROM. The suggested retail price is \$19.95. Contact Automated Simulations, POB 4247, Mountain View, CA 94040.

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Solar Design Programs

Version 2.0 of Solarsoft's Sunpas, Sunop, and Tswing interactive solar-analysis programs for 48K-byte Apple II Plus computers is now available. Given both the solar input and the load on the building, Sunpas and Sunop estimate the yearly auxiliary heating requirements of a passive solar building. Both programs are based on Los Alamos National Laboratory's Solar Load Ratio Method, which is described in volume two of the *Passive Solar Design Handbook* (available for \$30.50 from National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161). With documentation, Sunpas and Sunop cost \$250 each or \$400, if purchased together.

Tswing is a nodal-analysis thermal-simulation program that helps predict temperature swings in a building. It is useful for sizing mass and glazing areas to prevent overheating. Tswing makes extensive use of graphs to supplement hard-copy printouts of data. Provided with Tswing is Solgain, a clear-day solar-insolation routine to calculate incident and transmitted hourly solar gains. Tswing costs \$395, including a 60-page manual.

Sunpas, Sunop, and Tswing can be purchased as a three-program package for \$700. Yearly subscriptions to an updating service are available for \$75, and users manuals

without software may be obtained for \$25. Get additional details on these programs from Solarsoft Inc., POB 124, Snowmass, CO 81654, (303) 927-4411. Circle 576 on inquiry card.

PILOT for CP/M

Owners of CP/M-based computers can now run the Nevada PILOT language, thanks to Ellis Computing. A string-oriented language, Nevada PILOT is designed for interactive applications such as data entry, programmed instruction, and testing. Among its many features are an integrated full-screen text editor and the ability to drive video-tape recorders, voice-response units, and other optional equipment. With Nevada PILOT, someone with no prior computer experience can develop dialog programs in an hour or so. Nevada PILOT meets all PILOT-73 standards.

Nevada PILOT requires 32K bytes of RAM (random-access read/write memory), one disk drive, a video display and keyboard. It will run on TRS-80, North Star, Superbrain, Micropolis, Vector, Softcard-equipped Apples, and many other CP/M-based systems. Nevada PILOT costs \$149.95, which includes a floppy disk and a manual, and is available from Ellis Computing, 600 41st Ave., San Francisco, CA 94121, (415) 751-1522.

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Advanced Star Raider Tactics and Strategies

C. Donald Harris Jr.
508 Misty Lane
Friendswood, TX 77546

I assume that by now most people who own both an Atari 400 or 800 computer and the Star Raider game cartridge have either reached some level of proficiency or given up the challenge entirely and gone on to other interests. This article is directed toward those of you who have mastered the easier levels of the game, who thoroughly understand Atari's *Star Raider Users Manual*, and are ready to attempt more hazardous adventures.

From my viewpoint, the four levels of difficulty should be considered in two groups:

- The beginner group (Novice and Pilot levels) will be entirely satisfying for those of you who enjoy the game but wish to avoid addiction. At the beginner levels, your ship is small, almost indestructible, and will only be attacked from the front.
- The expert group (Warrior and Commander levels) requires considerably greater skills. Your ship is larger,



Photo 1: The view from the bridge of this "sit-in-'em" game of galactic strategy.

more vulnerable, and will be subjected to aft attacks or even simultaneous front and aft attacks.

I look at the Warrior level as basic training for the Commander level and suggest that your advanced training begin with that approach. Don't expect much in the way of rank at the Warrior level—the game-completion bonus is too low. A week or so of practice at the Warrior level will sharpen your skills considerably and, with the tips provided in this article, you should

be prepared for mastery of the Commander level.

Overall Strategy

You should first reach a fair amount of proficiency at the Pilot level. For example, you should be able to fly "on instruments." Without stopping to think, you should know at once where the *Enemy*, the Zylon, is from the azimuth, elevation, and range instruments on the display and which way to move the joystick to maneuver your

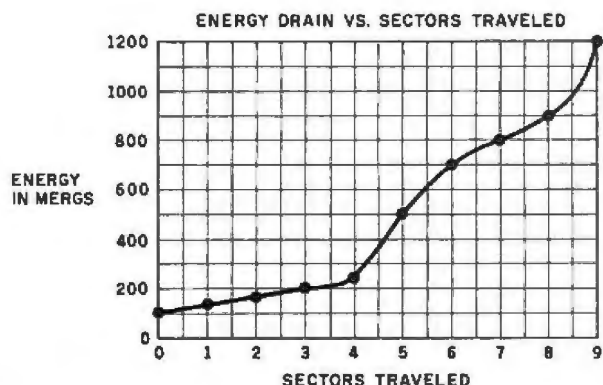


Figure 1: Energy drain for hyperwarp engine use. The drastic increase in energy use over distances greater than four sectors emphasizes the need to plan movement within the galaxy so that only short jumps are required.

craft. You should also know how to conserve energy during hyperwarp and when using the twin ion engines.

To properly prepare to wipe out your enemy, your battle plan should be designed around three priorities: survival, defense of starbases, and energy conservation. The main objective of course is survival (no easy task at the Commander level).

To begin the attack, switch to the Galactic Chart and press "P" (the Pause command). Now, it's study time: note the locations of your starbases in relation to the enemy's ships. This should help you plan your hyperwarp jumps from sector to sector more efficiently. The early-game strategy for defending starbases will include determining the starbase under attack and eliminating the fastest-moving enemy squadrons first. (Never go after a four-ship enemy squadron first, because you will find a starbase surrounded before you know it.)

You won't be able to figure out which starbase is first on the Zylons' hit list right away. It may take 150 to 200 centons (time units) of tracking enemy squadron movements to decide. In this interval, you should have blitzed your second or third two-ship squadron. Pick a nearby two- or three-ship fleet (they are faster!) and attack it. A caution: don't stray too far from the galactic center until you're certain which starbase to defend. You don't want to waste energy crossing the entire galaxy to begin your starbase defense. Don't forget about passing centons. Check the galactic chart during lulls in the fighting and note enemy-squadron movement. Don't forget to make your hyperwarps short jumps to save energy. Figure 1 shows the energy units used compared to hyperwarp distances out to nine sectors. Notice the large

energy increase for five sectors or more, and again over eight sectors. Once you've identified the starbase under attack, mop up the sector you are in, if you feel there is time, and move to defend your starbase.

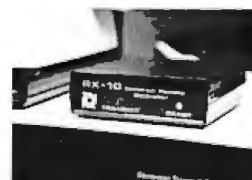
As your attack continues, you should stay near the starbase under attack and let the Zylons come to you; but watch the tricky Devils—when you least suspect it they will switch starbases and begin moving to a new target. Continue to wipe out the two- and three-ship fleets first. Once you've done that, the pressure is off your starbases. Now that I've laid out the overall strategy, let's proceed with the fun part: wiping out the evil vermin.

Behind Enemy Lines

While in an enemy sector and attempting to destroy Zylons, your objectives are survival and energy conservation. The main energy drains inside the sector result

Text continued on page 392

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Videosyncrasies

Anyone who has not been a *Star Raider* might not understand the fascination that envelops one when playing the game—the many hours that go into learning how to swerve away from incoming photon torpedoes, the frustration of losing control of the ship while in hyperspace and then emerging in some empty nether region of the galaxy while the dastardly Zylons surround and destroy your last starbase. Atari's *Star Raider* is the first, and so far the best, of a genre that I call "sit-in-'em" games.

Let me explain that, as a *Star Raider*, you are actually sitting in your ship, seeing stars, Zylons, starbases, and the rest of a vast galaxy whiz by as if you were looking out a window. Don't confuse *Star Raider* with the more common "map" games like *Space Invaders* or *Pac-Man*, where you look down at a map of yourself and your opponents. In *Star Raider*, you are pilot of a one-man ship with all the expected properties of a military vessel capable of roving the galaxy: it has weapons, defenses, and communications equipment; it

has inertia; it can be damaged and, when it is, you are in trouble.

Although map games have their place (as evidenced by the continuing popularity of chess), this is the type of game that best employs the power of the computer, because it uses the computer to give you capabilities that would otherwise be impossible. It puts you somewhere you could not normally go. I must admit that "sit-in-'em" games are now the only type I will stoop to conquer. My jaded imagination can no longer be excited by watching my "blip" shoot at the computer's "blip" on a screen—too impersonal.

Star Raider is probably the single greatest contributor to the sales of Atari's 400 and 800 series computers. People seem to buy the computer just to get the game, and then they find out that it can be useful in other ways too (but *Star Raider* still gets top priority). If you're thinking about writing a game for personal computers, *Star Raider* is the one to beat.

Here's a collection of notes and observations I have

Text box continued on page 388

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BYTE'S ARCADE

Text box continued:

made after, literally, several hundred hours of playing the game. These tricks and considerations, as well as those Mr. Harris mentions, are the ones that I now employ whenever I play Star Raider. If you are a beginner to the game, perhaps you might want to consider waiting to read this—a large part of the enjoyment of the game is learning how to win.

Understanding the Zylons

- Never lose sight of the fact that the name of the game for the Zylons is destruction of your starbases. To do this, they surround a starbase, cut off its supplies, and kill it, then build two ships out of the wreckage.
- Once a starbase is surrounded, you have only a certain amount of time to save it.

Planning

- Remember that while you are docked at a starbase, you can view the galactic chart and set up for your next hyperspace jump. That way, when "transfer complete" appears on your screen, you can immediately enter F (Forward view) and then H (hyperspace). Not only does this save time, but you get to watch the repair ship flash by (and probably scare the dickens out of its crew).
- Zylon task forces vary in size, but the smallest ones always move toward starbases the fastest; wipe them out first.
- Zylons jump into hyperspace on time units ending with .00 and .50, so check the time when you're planning your next hyperjump—if the clock is between .40 and .49 or between .90 and .99, it's worth your while to wait and watch time—they will very likely move out from under you if you don't.
- As long as your subspace radio is working, you will get a message whenever a starbase is surrounded. Early in the game, when there are a lot of fast Zylon squadrons around, it's best to go to the starbase's aid immediately.
- If you know you can't save a surrounded starbase, admit defeat and go in and blow it up yourself as soon as you can (see the next section on how to hyperwarp directly to starbases). You'll be penalized, but not as much as if the Zylons had done it; and this way, they don't get to use the wreckage to build more ships.

Saving Energy

- If you want to, you can turn off shields, etc., to save energy during hyperwarps.
- You can usually hyperwarp directly to a starbase by centering the indicator on the attack-computer display as you enter the starbase's sector. This lets you "coast" right up to the base.

Text box continued on page 390

Text box continued:

● If you can't swerve in time, it's best to blast incoming enemy rounds: photons cost you 10 mergs, but taking a hit costs 100 mergs (plus damage).

Battle Techniques

● Note that your fired photons never go above the horizontal crosshair on your screen, so it seems advisable to keep Zylon ships below the crosshair too.

● Any hits that you receive toward the center of your screen seem to do much more damage than those on the periphery.

Damaged Equipment

● Use the sector scanner only as a backup device for the times that your computer is out of commission. It takes too long to adjust your course by using the sector scanner; rather, learn to rely on the instruments and the attack-computer display.

● When your ion engines are damaged, note that the velocity indicator flickers between 0 and 12; if you then try to select a speed, the speed indicator flickers between 0 and 6. If you're going after a Zylon who damages your engines, don't touch the speed controls.

● Your hyperwarp engines can be used within a sector if your ion engines are damaged. Simply abort hyperwarp by selecting speed 0 when you get to where you want to go (you'll lose the speed advantage described above, and it'll cost 100 mergs to abort the hyperwarp).

Videosyncrasies or Things That Happen but Shouldn't

● The animation slows for several seconds after an explosion; it may speed up at an inopportune moment. The effect is that your ship responds slowly as you try to line up on a Zylon, then, all of a sudden, his ship zips in and fires very quickly.

● When looking through an aft view, always turn toward incoming enemy rounds to avoid being hit.

● At the higher difficulty levels, some enemy rounds may seem to go by but still score damage.

● The tracking computer is a handy tool; learn to use it, but watch out: if you destroy a Zylon in front of you after he has fired, the tracking computer will switch to aft view and the enemy round will score—learn to swerve if this happens.

Further Fun

● It seems to help your cause if you call the Zylons by name. Suggestions are:

Vermin	Zyloons
Villains	Zyklowns
Nasties	Zylarks
Dastard	Hey You!

● If you think you're getting good at it, try playing Sudden Death (Warrior level with no shields).

Damn the photons! Full speed ahead! . . . CPF

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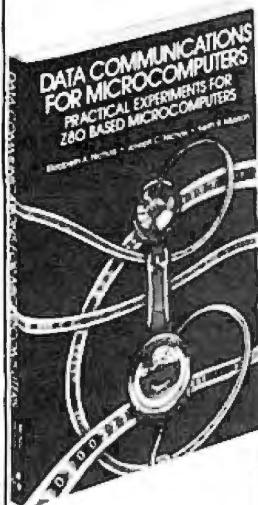
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Text continued from page 385:

from hits from enemy photons and using the twin ion engines. By far the most important of these is avoiding being hit by enemy photons. Each photon hit costs 100 mergs (energy units) and causes damage. Damage not only reduces your chances of survival, but certain kinds of damage will mean an unplanned trip to the nearest starbase for repairs. This extra trip could cost 300 to 800 mergs or more. Eight hundred mergs is equivalent to about eight final-score points, or the difference between ranks of Star Commander 1 and Star Commander 2.

The ion engines should seldom be needed in the enemy sector. As your ship comes out of hyperwarp and coasts to a stop, three different types of enemy movements will be found: ships with no movement, fast-moving ships that will seem to approach you but then retreat, and ships coming on at full-speed attack. Notice that ships within 120 metrons (distance units) will always attack, become visible, and be within photon range.

Don't trust your tracking computer to lock on to the nearest enemy vessel. If you are not immediately under attack when entering a sector, press M (the manual-tracking key) to avoid nasty surprises. If a ship is coming on at full speed, just wait for it. When a ship seems to be coming in for an attack, but then takes off in some other direction, don't chase it because that's the sucker move. Scan the sector for another ship to attack. If you have the time and patience and are willing to wait, the enemy will eventually come to you. (But don't forget that your starbase is under attack while you are waiting.) Early in the game at the Commander Level, you cannot afford to wait.

Contrary to what the user's manual tells you, speed 6 is not the most efficient way to use your ion engines. Energy requirements for shields, computers, and life-support systems must be accounted for during the journey. According to the manual, the energy drain for these systems is 2.75 mergs/centron (energy units per time unit). Although my tests show a lower energy consumption, the most efficient speed is actually 8 not 6. Figure 2 shows calculated and measured energy consumed for distances of 500 and 900 metrons. The calculated values are based on information taken from the user's manual. In either case, there is little difference in energy used for speeds above 7.

Engaging the Enemy

As you come out of hyperwarp and coast to a stop, you will often find yourself overrunning an enemy ship and being fired on before you are ready to defend yourself. Try this! As the ship comes within about 150 to 200 metrons, throw your ship into a hard turn in either direction. Hold the turn until the enemy has passed all the

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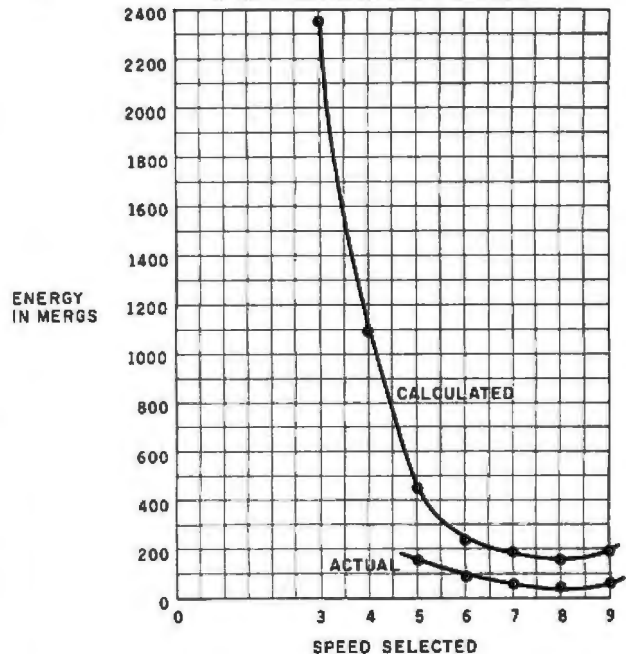
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MEK6800 evaluation system w/8K, and docs	125
Autocontrol single board CP/M system, 10 MHz with power supply and two 8" Double sided/Double density MPI drives	negot. 2400
Western Digital Pascal Microengine w/UCSD Pascal and two 8" drives	2000
Shaffstall EDI7700 phototypesetter floppy disk interface for use with Compugraphic Editwriter series typesetting equipment, with standard ASCII translation software. Excellent condition.	8500
Three SCION word processing subsystems complete with keyboard, monitor, S-100 display board, and Wordsmith editing software	1200 ea. or 3/3000
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BYTE'S ARCADE

2a

ENERGY CONSUMED VS. SPEED
OVER A DISTANCE OF 500 METRONS



2b

ENERGY CONSUMED VS. SPEED
OVER A DISTANCE OF 900 METRONS

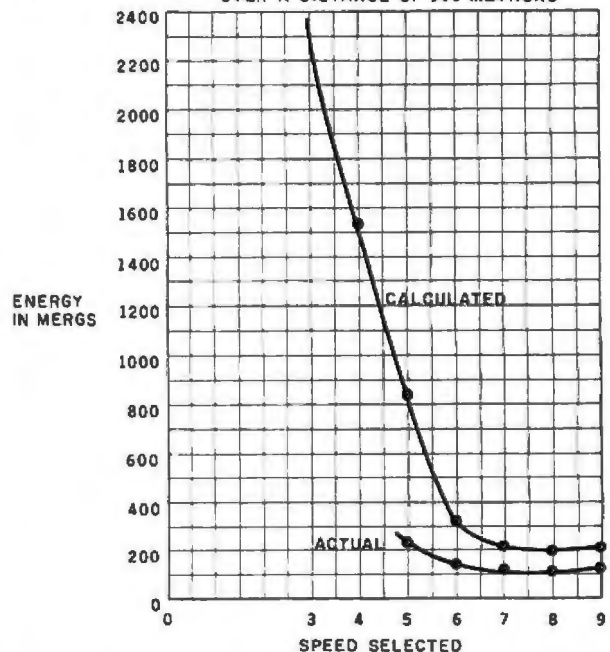


Figure 2: Energy expended for ion engine use. Contrary to the figures in the user's manual, selected-speed 8 is most efficient when other systems are also drawing energy. Figure 2a shows the energy expended at a variety of speeds over 500 metrons. Figure 2b shows the corresponding values for a distance of 900 metrons.

Priority	Name	If Damaged	If Destroyed
1	shields	hyperwarp at once	hyperwarp at once
2	photons	finish sector if even odds	hyperwarp at once
3	computer and sector scan	finish sector if even odds	hyperwarp at once
4	subspace radio	—	finish sector
5	computer	continue	finish sector
6	engines	continue	continue
7	sector scan	continue	continue

Table 1: Damage priorities determine when to leave for repairs immediately. In the chart, "finish sector" means wait until you have disposed of all the Zylons in the sector before hyperwarping to a starbase; "finish sector if even odds" means go for repairs immediately unless there is only one Zylon in the sector. If more than one piece of equipment is damaged, follow instructions for the highest-priority item.

way behind you and is coming around the front again. Watch your instruments. By this time the screen will have stopped flashing, and you will be ready to fight with no distractions.

As the enemy approaches from the front, maneuver your joystick to keep him off to the side and low. The idea is, of course, to avoid photon hits and damage as he approaches. When the enemy is about 20 metrons away, swing him into your sights and blow him away. Conserve your photons—they cost energy too. Don't let the Zylon get much closer than 20 metrons before using this maneuver, because he just might zip around behind you. If two ships are attacking from the front at once, concentrate on the one closer to the center of the screen.

A word about attacks from the rear: for several weeks I tried to handle aft attacks without much success. If you can handle a frontal attack one second and an aft barrage the next (with all your joystick movements reversed), that's great; but I've found that you can still reach Star Commander 1 without mastering the aft attack. To bring an aft-attacking enemy to the front, just throw your ship into a hard spin and he will wind up in front of you. You will notice that you are almost never hit while in a spin.

The toughest situation is simultaneous front and aft attacks. You can quickly turn off autotracking (press T) to concentrate only on the front. I've already suggested how to handle frontal attacks, but in this situation throw in a small amount of back and forth joystick movement. This hurts the aim of the aft attacker.

Necessary Capabilities

How do you know when to cut and run? For some kinds of damage, there is no doubt. Some systems, however, are more important than others, so the decision is not clear cut. Table 1 is presented for your use as a guide only. Many other damage combinations are possible and are left to your judgment, skill level, and the game situation. To help explain the chart, here are some examples:

- In a case where your photons are damaged, finish the sector if only one enemy ship remains and then go to the nearest starbase for repairs. If you are outnumbered, leave the sector immediately.
- In a case where your computer and the sector-scan systems are damaged and your ion engines are destroyed, finish the sector if you are faced with only one Zylon, then go for repairs.

A final hint: your subspace radio is much more important early in the game than it is later when enemy ship movements are not as threatening.

What I've described here is just about all I know about Star Raider. I hope these suggestions will be helpful to your pursuit of new and better ranking and many more hours of enjoyment. ■

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Software Received

Apple

Adventure, an implementation of the original adventure game. For the Apple II; floppy disk, \$10. Frontier Computing Inc., 666 North Main, POB 402, Logan, UT 84321.

Automaniac System, requiring an onboard clock card, this system can run a program or series of programs without supervision at a predetermined date and time. For the Apple II; floppy disk, \$100. Geegery Software Works, POB 8028, Des Moines, IA 50301.

Chess Connection, a telecomputing chess game that requires two computers equipped with modems for an interactive game. For the Apple II; floppy disk, \$35. Telephone Software Connection Inc., POB 6548, Torrance, CA 90504.

Choplifter, an arcade-type game. You control a helicopter in an effort to rescue hostages held captive in a foreign country. For the Apple II; floppy disk, \$34.95. Broderbund Software, Entertainment Software Division, 1938 Fourth St., San Rafael, CA 94901.

Escape from Rungistan, an adventure-type game. You must contend with cannibals, snakes, guerilla warriors, and a mad dictator's revenge while trying to escape from this interesting jungle nation. For the Apple II; floppy disk, \$29.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Fly Wars, an arcade-type game. You maneuver a spider to trap the flies. For the Apple II; floppy disk, \$29.95. Sirius Software Inc. (see address above).

Go-Moku, a telecomputing version of the oriental board game go-moku. This program requires two computers equipped with modems for

an interactive game. For the Apple II; floppy disk, \$20. Telephone Software Connection Inc. (see address above).

Graphics Processing System: Professional Version, a graphics development system that lets you create, manipulate, and edit images. Includes zoom, two-dimensional rotation, and overlay functions. For the Apple II Plus; floppy disk, \$99.95. Stoneware Inc., 50 Belvedere St., San Rafael, CA 94901.

Horse Racing Classic, a highly detailed simulation of horse racing for one to nine players. You can check a horse's statistics, place bets, and watch the race. For the Apple II; floppy disk, \$36.95. Tasumi Software International Inc., 8 North Grosvenor Ave., Burnaby, British Columbia, V5B 1J2 Canada.

Millionaire, a stock-market game that lets you simulate investing in the stock market. You can examine company histories and buy stocks using a variety of options. For the Apple II; floppy disk, \$49.95. Micro-Z Applications, Suite 141, 22704 Ventura Blvd., Woodland Hills, CA 91364.

Real Estate Models for the Eighties, Visicalc templates for real-estate analysis. Using the Visicalc program, you can calculate figures for a wide variety of mortgages and amortization plans. For the Apple II and III; floppy disk, \$65. Commercial Software Systems, 7689 West Frost Dr., Littleton, CO 80123.

Speed Reader, a series of programs to help increase your reading speed. For the Apple II; floppy disk, \$70. Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014.

The Snapper, an arcade-type game. You must travel around the grid collecting blots but avoiding the

Gamma Field and Whirlers. For the Apple II; floppy disk, \$32.95. Silicon Valley Systems, Suite 4, 1625 El Camino Real, Belmont, CA 94002.

Statistics with Daisy, a data-analysis and interactive-statistics package. You can sort, analyze, and plot data using simple, easy-to-learn commands. For the Apple II; floppy disk, \$79.95. Rainbow Computing Inc., 19517 Business Center Dr., Northridge, CA 91324.

Super-Text, a word-processing program that works with both 40- and 80-column screens. Instructions to make the shift key operational when used with a lowercase adapter are included. For the Apple II; floppy disk, \$175. Muse Software, 347 North Charles St., Baltimore, MD 21201.

System/ASM 3A, an assembly-language development system that features a two-pass assembler, full-screen editor, and disk-file management. For the Apple II Plus; floppy disk, \$35. Mike Piasek Co., 15401 Maple Park Dr. #11, Maple Heights, OH 44137.

Tele-Gammon, a telecomputing backgammon game. The program requires two computers equipped with modems for an interactive game. For the Apple II; floppy disk, \$35. Telephone Software Connection Inc. (see address above).

Understand Yourself, a series of nine tests to help you understand your feelings about marriage, sexual attitudes, and other aspects of your life. For the Apple II Plus; floppy disk, \$24.99. Huntington Computers, 1945 South Dairy Ave., POB 787, Corcoran, CA 93212.

Wizardry: Knight of Diamonds, the second scenario in the Wizardry game series. For the Apple II; floppy disk,

\$34.95. Sir-tech Software Inc., 6 Main St., Ogdensburg, NY 13669.

Wizardry: Proving Ground of the Mad Overload, a multiplayer fantasy and adventure game. You can develop your own characters in a Dungeon and Dragons-type game setting. For the Apple II; floppy disk, \$49.95. Sir-tech Software Inc. (see address above).

Atari

Alvin, an arcade-type game. A reverse on the Missile Command format; you control the missiles trying to destroy a robot city. For the Atari 400 and 800; floppy disk or cassette, \$21.95 and \$17.95, respectively. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Frog Master, a graphics program illustrating the use of operant conditioning. Through positive reinforcement, you train your frog to penetrate barriers and score goals for you. For the Atari 400 and 800; floppy disk or cassette, \$21.95 and \$17.95, respectively. Dynacomp Inc. (see address above).

Golf Pro, a simulation of a golf game using color and graphics. For the Atari 400 and 800; floppy disk or cassette, \$21.95 and \$17.95, respectively. Dynacomp Inc. (see address above).

NYIndex, a program that can store and plot up to three years of New York Stock Exchange information, from which you can determine the trend of the market based on past behavior. For the Atari 400 and 800; floppy disk, \$29.95. Dynacomp Inc. (see address above).

Quintominoes, a screen-based jigsaw game. For the Atari 400 or 800; floppy disk or cassette, \$16.95 and

\$12.95, respectively. Dyna-comp Inc. (see address above).

Heath

Space Odyssey I, an arcade-type game. Retrieve your deep-space probes as you maneuver around or destroy asteroids, alien fighters, and mysterious objects. For the Heath H-8 and H-19 or H-89; floppy disk, \$21.50. Evryware, POB 60802, Sunnyvale, CA 94088.

Y-Wing Fighter, an arcade-type game. Pilot your fighter in a crucial mission to destroy the enemy's base. For the H-8 and H-19 or H-89; floppy disk, \$19.50. Evryware (see address above).

IBM Personal Computer

Millionaire (see description above). For the IBM Personal Computer; floppy disk, \$49.95. Micro-Z Applications, Suite 141, 22704 Ventura Blvd., Woodland Hills, CA 91364.

Real Estate Models for the Eighties (see description above). For the IBM Personal Computer; floppy disk, \$65. Commercial Software Systems, 7689 West Frost Dr., Littleton, CO 80123.

Speed Reader, programs to help increase reading speed. For the IBM Personal Computer; floppy disk, \$74.95. Davidson and Associates, 6069 Groveoak Place #14, Rancho Palos Verdes, CA 90274.

TRS-80

ABE: Advanced BASIC Editor, a BASIC programming editor that lets you list programs a page at a time, use global search and replace to modify a program, and write commands with a single key press. For the TRS-80 Model I; floppy disk, \$19.95. Interpro Corp., POB 4211, Manchester, NH 03108.

Bounceoids, an arcade-type game. Try to clear the

Bounceoid boulders from the screen while avoiding the Bounceoid creatures. For the TRS-80 Models I and III; floppy disk or cassette, \$19.95 and \$15.95, respectively. The Cornsoft Group, 6008 North Keystone Ave., Indianapolis, IN 46220.

Co-Dir, a cursor-oriented directory. Select programs from a directory by positioning the cursor next to the filename. For the TRS-80 Models I and III; floppy disk, \$19.95. Picotrin Technology, 3531 San Castle Blvd., Lantana, FL 33462.

Copy-Tape, a cassette tape-duplication program. For the TRS-80 Models I and III; cassette, \$11.95. Modtec, 4144 North Via Villas, Tucson, AZ 85719.

IDM-X, a database-management system. Features include a built-in sort and merge package and a fast key-access method for quick record access. For the TRS-80 Model II; 8-inch floppy disk, \$399. Micro Architect Inc., 96 Dothan St., Arlington, MA 02174.

Interpro Flexible Mailing List, a mailing-list program. You can custom program a mailing list to your exact specifications. Up to 1000 names per disk are possible. For the TRS-80 Models I and III; floppy disk, \$127. Interpro Corp. (see address above).

Maxi CRAS: Check Register Accounting System, a check writing and recording system. Using its menu-driven format, CRAS lets you set up income- and expense-account reports showing activity of one or more accounts over a period of time. For the TRS-80 Models I and III; floppy disk, \$99.95. Adventure International, 507 East St., POB 3435, Longwood, FL 32750.

Personal File Manager, a database-management program. Designed for everyday use, this program features format-free file structures

that accept almost any type of data. For the TRS-80 Color Computer; floppy disk, \$17.95. Home Information Systems, 4006 Ellicott St., Alexandria, VA 22304.

Pocket Computer Primer, companion software to the book of the same name. Includes a variety of programs for home and office use. For the TRS-80 Pocket Computer; cassette, \$8.95. Micro Text Publications Inc., Suite 27C, One Lincoln Plaza, New York, NY 10023.

Pocket Magic, companion software to the book of the same name. Includes a variety of simulations and games. For the TRS-80 Pocket Computer; cassette, \$8.95. Micro Text Publications Inc. (see address above).

Records, a student grades record-keeping system. This system can handle as many as 200 students and it provides

class rosters, evaluation scores, and final grades. For the TRS-80 Model III; floppy disk, \$69.95. Microsoftware Services, POB 776, Harrisonburg, VA 22801.

Science and Engineering Sourcebook, companion software to the book of the same name. Includes a variety of programs for professional use. For the TRS-80 Pocket Computer; cassette, \$8.95. Micro Text Publications Inc. (see address above).

Spector of Kzirla, a graphics adventure game. Wind your way through the 13 floors of the maze as you slay monsters, collect treasures, fly a magic carpet, and even commit hari-kari if necessary. For the TRS-80 Color Computer; floppy disk or cassette, \$21.95. Rainbow Connection Software, 3514 6th Place NW, Rochester, MN 55901.

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real-time clock to my system so that I could couple it to my environmental telemetry sensors. I plan to bury 8 geothermal sensors spaced at 10 inches (25 cm) vertically and a ninth sensor for surface temperature. Over the course of a year, I should be able to gather enough temperature data to be able to intelligently calculate how much soil I will need over an underground home that I plan to build. By having the accurate date and time, I will know the latency of a surface temperature shift, and how it will affect the temperature at different depths.

Gary R. Casady
Pinckney, MI

Using date and time signals from WWVB as a real-time clock for your TRS-80 is certainly feasible, but it requires sophisticated equipment because of the slow rise times of the time codes. The transmitted signal must be phase-controlled to the UTC (Uni-

versal Coordinated Time) time scale and the receiver must have a very narrow bandwidth (0.01 to 0.001 Hz) to extract the VLF (very-low frequency) signal from the noise level in this frequency band (60 kHz).

Rather than use all of this equipment, I would recommend the "Timedate 80" from Alpha Products, 79-04 Jamaica Ave., Woodhaven, NY 11421, (800) 221-0916; in New York, (212) 296-5916. It's totally compatible with your TRS-80 and sells for only \$95, fully assembled and tested.

The accuracy of this unit is controlled by a quartz crystal and should be more than adequate for your application. From an advertisement, I can envision many other applications for this unit. . . . Steve

An Investment In Education

Dear Steve,
My 12-year-old son has an

interest in programming. He learned BASIC II at local community colleges. His initial interest is in video games, and he has written some neat game programs.

I want to encourage his interest but cannot afford a decent microcomputer. I have an Atari Video Game system, television, and a data terminal (Texas Instruments "silent 700") that he can use. It appears all we need is memory and mass storage. Is there any device with such capability that can be integrated with this equipment? Frank Plona
Collinsville, CT

The Atari Video Game System does have a BASIC option that consists of a cartridge and a keypad. It is supposed to enable programming in BASIC, but I am not aware

of any storage device (i.e., cassette recorder) for it. It must be recognized that this system was designed as a game player and not as a programmable computer.

I would suggest that you look into one of the low-cost microcomputers on the market, such as the Commodore VIC-20, Atari 400, Radio Shack TRS-80 Color Computer, or the Sinclair ZX81.

With the exception of the \$100 ZX81, these units are in the \$300 to \$400 price range and feature a full BASIC language, graphics, memory, and a keyboard so that programming may be accomplished both easily and efficiently.

These units offer a lot of features for the money and represent a good investment in your son's education. . . . Steve ■

In "Ask BYTE," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

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If you are a subscriber to The Source, send your questions by electronic mail or chat with Steve (TCE317) directly. Due to the high volume of inquiries, personal replies cannot be given. Be sure to include "Ask BYTE" in the address.

BYTE's Bits

Call for Papers

A call for papers on computers and computer applications in any area of interest to college and university instructors and administrative personnel has been issued by the California Educational Computing Consortium. The papers are to be delivered at the Seventh Western Educa-

tional Computing Conference to be held in San Francisco, California, during November 1983. Send two copies of your original paper to Professor Virginia Lashley, Coordinator of Instructional Computing, Glendale College, 1500 North Verdugo, Glendale, CA 91208. A deadline of March 1, 1983, has been imposed. ■

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What's New?

and one 8-inch disk drive. It uses Heath/Zenith H-19/219 terminal escape codes. The program is supplied on an 8-inch standard CP/M-format disk. A user's manual with four examples is provided. Loan-Master costs \$31.95 and can be purchased factory-direct from Generic Software, POB 1154, Troy, MI 48099, (313) 879-6903. Enclose \$2 for shipping and handling. Circle 503 on inquiry card.

Atari Markets Telecommunications Kits

Atari's Telelink II cartridge stores and automatically dials your two most frequently called information service numbers and corresponding access codes. Telelink II lets you dial numbers from the computer's keyboard or from the telephone. Available in kit form, Telelink II has a suggested retail price of \$79.95.

Also in kit form, the Communicator II uses the Telelink II and Atari's 835 direct-connect modem to connect your 400 or 800 microcomputer with information services and other computers. Communicator II has a suggested retail price of \$279.95, including a manual and one free hour on the Compuserve Information Service, the Dow Jones News/Retrieval Service, and The Source. The 835 modem connects directly to your telephone lines and is available only with the Communicator II.

For further details on these products, contact Atari Inc., 1265 Borregas Ave., POB 427, Sunnyvale, CA 94086, (800) 538-8547; in California, (408) 745-2230. Circle 504 on inquiry card.

Professional Tax-Preparation Package

Microcomputer Taxsystems' Micro-Tax software family is designed for professional tax-preparers. It runs on CP/M, MP/M, and IBM Personal Computer DOSes (disk operating systems) and handles federal, state, partnership, and corporate returns. Micro-Tax computes and prints more than 30 schedules and forms for multiple clients and it can compute depreciation by individual items or groups. Standard features include income averaging, the ability to handle accelerated cost-recovery systems, and automatic computation of underpayment penalties, self-employment taxes, minimum and alternative minimum and maximum taxes. Yearly updates can be produced.

A demonstration package of the 1981 Micro-Tax Federal Professional Level 2 system is available for \$50, plus shipping and handling. For full details on Micro-Tax, contact Microcomputer Taxsystems Inc., Suite E, 22458 Ventura Blvd., Woodland Hills, CA 91364, (213) 704-7800. Circle 505 on inquiry card.

RATS in Your Field Service

RATS (remote access troubleshooting) lets your field personnel service logic-level electronics without the need for a highly trained technician to be present at the scene. Developed primarily for the seismic industry, RATS equipment requires little or no technical expertise because personnel are guided through the troubleshooting sequence by means of a telephone link-up with your technicians. After the probes are positioned, the technician at your home office receives the oscilloscope display as if he were at the instrument in question. For full details, contact Mountain Systems Service, 6477 East 58th Ave., MDS#423, Commerce City, CO 80022, (303) 289-5614. Circle 506 on inquiry card.

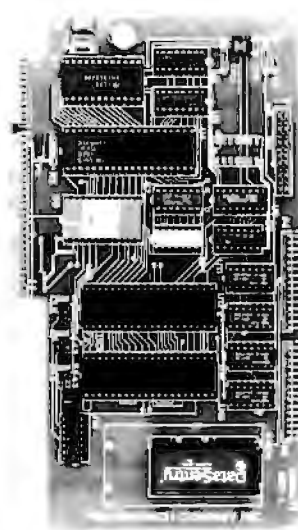
Stock-Market Analyst

Kate's Computers designed its Analyst stock-market graphics package for most S-100 bus computers equipped with a graphics card, the Apple II, and the North Star Advantage. Analyst lets you plot stock, bond, commodity, and opening prices using a variety of formats, including bar charts, point and figure, and logarithms. Up to 20 years of past market history can be stored and analyzed with a range of technical methods, such as moving

averages on price and volume, trend lines, and moving and weighted moving averages. This program will work with either hard-disk or floppy-disk systems.

Optionally, the Analyst can be purchased with relative strength and overbought and oversold indicators. Custom modules can be created. Analyst costs \$595; volume discounts are available. Contact Kate's Computers, POB 1675, Sausalito, CA 94965, (415) 332-9434. Circle 507 on inquiry card.

PERIPHERALS



Multifunction Utility Board for the H-89

FBE Research Company has unveiled the H89UT1 multifunction utility board for Heath H-89, Zenith Z89/Z90, and Magnolia Microsystems Z89 systems. The board, which replaces the standard serial I/O board, comes with

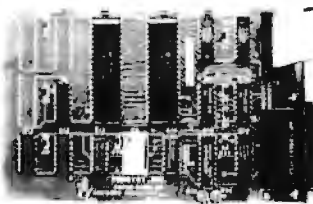
What's New?

drive IBM, includes CP/M, Byad's utilities, and utilities such as SUBMIT, PIP, and STAT.

Under normal IBM PC operation, the Model DS2 gives you an additional 64K bytes of RAM and an optional serial port. When the software is booted, CP/M takes over as your operating system. The two processors, the Z80B and the IBM's 8088, then run as a distributed processing system, with the Z80B functioning as the central processor and the 8088 as an intelligent I/O controller.

The Model DS2 expansion circuit with a serial port and the software package costs \$760. A model without the serial port, the DS1, is available for \$660. For further details, contact Byad Inc., 5345 North Kedzie Ave., Chicago, IL 60625, (312) 539-4922.

Circle 515 on inquiry card.



Communications Controller Boards for the IBM

Single- and dual-channel asynchronous communications controller boards for the IBM Personal Computer are available from Personal Systems Technology. The boards have a rotating jumper plug that switches the transmit and receive signals in the con-

nect, programmable data rates from 50 to 19,200 bps (bits per second), full modem support, false start-bit and line-break detection, and line generation. An interrupt system controls transmit, receive, error, and modem status-change interrupts, while the IBM's diagnostic capabilities take advantage of loopback functions for transmit or receive and I/O signals. Full-duplex operation is supported, and double buffering is provided, which eliminates the need for precise synchronization. Other features include support of 5-, 6-, 7-, or 8-bit characters with 1, 1½, or 2 stop bits and even, odd, or no parity bit generation and detection.

The single-channel asynchronous communications board costs \$130. The dual-channel model lists for \$195. Quantity discounts are available. For more information, contact Personal Systems Technology Inc., 22957 La Cadena, Laguna Hills, CA 92653, (714) 859-8871.

Circle 516 on inquiry card.

PUBLICATIONS

Free Newsletter on Interact

RAM Pages is a free 12-page monthly newsletter for fans of the Interact personal computer. It has articles on converting programs for operation on the Interact, hints on hardware, letters to the editor,

and programming tips.

RAM Pages is available upon request from Micro Video, 305 North First St., POB 7357, Ann Arbor, MI 48107, (313) 996-0626. Circle 517 on inquiry card.

Survey of Computer Retailers Depicts 1981 Market

Future Computing has released the results of its survey of computer retailers and dealers. The survey included Apple dealers, Computerlands, Zenith dealers, consumer electronics and computer stores, systems houses, and office products dealers. The published results contain data on the 1981 computer marketplace as furnished by 341 respondents. Information provided shows computer sales by brand, computers no longer carried and why, computers to be added, printers and disks by brands, software sales by brand, sales mix among types of products, customer types, initial purchase value versus first-year and second-year add-on value, future product interest, and more. Additionally, local networks and multiuser systems are covered.

The complete survey results can be purchased for \$1195. For further details, contact Future Computing Inc., 900 Canyon Creek Square, Richardson, TX 75080, (214) 783-9375. Circle 518 on inquiry card.

Atari Antics

Antic—The Atari Resource is a bimonthly magazine for Atari owners and users. It has articles on hardware and software for the Atari, programming tricks, comparisons of peripheral equipment, and listings of public-domain software. User groups are entitled to one free subscription to Antic in exchange for a subscription to their club's newsletter. Individual subscriptions to Antic are \$15 for 6 issues and \$27 for 12 issues. Foreign rates differ. Contact Antic Publishing, 297 Missouri St., San Francisco, CA 94107, (415) 864-0886.

Circle 519 on inquiry card.

Seminar Guide for Data-Processing Professionals

The SIS Workbook—EDP Edition organizes and condenses the information found in brochures from seminar groups. The tri-sectioned guide, produced by Seminar Information Service, describes various data-processing courses offered both publicly and on an in-house basis. Its first section lists and briefly describes more than 400 data-processing seminars. In the second part of the guide, you'll find the names and addresses for more than 60 seminar groups and organizations, plus a catalog detailing each group's offerings. The final section

Computer Animation with Color Registers

*The color registers on the Atari 400 and 800 microcomputers
give programmers amazing animation capabilities,
even in BASIC.*

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The process of drawing colorful images with a computer is fascinating and fairly easy to understand, but animating these images may be a bit difficult. Animation, of course, requires very fast color changes for each of the picture elements or pixels in an image. And many microcomputers may not be able to change a screen full of pixels fast enough for a smooth animation effect.

Fortunately, a technique known as *color mapping* had been used for years in the world of high-tech computer graphics. Here, instead of being directly assigned their colors, the pixels receive color information from a separate table of colors called a color map. By changing the color value of one entry in the color map, it is possible to immediately change the color of thousands of pixels without redrawing the image. Thus, some very-high-speed animation effects can be achieved.

To use this powerful technique, you need look no further than your local computer store. Unbeknownst to many people, the Atari 400/800 contains color-mapping hardware (called *color registers*), and this feature alone gives it awesome capabilities when compared to its competitors.

In this article, we will see how Atari's color registers can be put to work in colorful, action-packed, animated scenes. Color-register animation will be used in two programs: to create the illusion that you are rapidly flying through a trench (as in *Star Wars*), and to display the motion of water in a cascading waterfall.

The Magic Paint Store

Imagine a paint store shelf filled with 128 cans of different color paint. In front of you are nine empty "magic paint buckets," each one labeled with a number from 0 to 8. Each bucket has a brush in it with the corresponding number. Also, imagine a large canvas is on an easel before you, begging for a picture. Feeling inspired, you begin by filling the first bucket with a light-blue color, picking up the brush, and painting the sky on your canvas. When you have finished with that color, you fill another bucket with your second color selection and paint some more. You continue this process with the remaining seven buckets. When no empty buckets are left, you decide to empty Bucket 0 and fill it with a different color, a deep orange. Lo and behold, the sky in your picture, originally painted with Brush 0, immediately changes to orange as Bucket 0 is refilled! In fact, *everything* that was previously painted with Brush 0 now appears in the new color currently in Bucket 0! When you

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try this with Bucket 1, the same thing happens with everything previously painted with Brush 1. You have magically changed your painting from a cool midafternoon scene to a fiery sunset.

Using Color Registers

Color registers were first created to provide the users of professional computer paint systems with a relatively inexpensive way to use a polychromatic palette. In many of these systems, the artist chooses a palette of 256 colors from a selection of more than 16 million! When color registers (also called color maps) became popular, many advantages other than lower cost were discovered. An artist could alter some of the colors already painted without having to redraw an entire picture. In the field of computer animation, wonderfully animated scenes could be created without changing a single pixel simply by moving the colors around the color map! And in medical applications, as in the analysis of a computer image of an X-ray, formerly unnoticed details could be brought out by assigning contrasting colors to areas that had previously been depicted with only slight shading differences.

The Color Registers on the Atari

The Atari 400/800 is one of the few personal computers that uses this technique to display its colors on the screen. However, you have only 128 possible colors to choose from instead of 16 million (we hope you didn't get your hopes up!), and only nine entries (the color registers) in the color map, rather than 256. And most Atari graphics modes don't use all nine color registers. In fact, many use four or fewer. Table 1 lists most of the different Atari graphics modes and the color registers that are active for each.

First, let's do a brief overview of the table. The first

column lists the different Atari graphics modes and the number of colors each mode supports. The Default Colors are the colors set by the OS (operating system) when the computer is first turned on or System Reset is pressed. The SETCOLOR column gives the values for the SETCOLOR commands (which are used to change the color value in the color registers) for that mode. The POKE column lists the corresponding addresses in memory of the color registers for each mode. By using the POKE com-

The ability to change the color of a specific area on the screen instantaneously can be used to create the effect of high-speed motion without resorting to assembly-language programming.

mand to put numbers into these addresses, you can bypass the SETCOLOR command for faster color changing. (This is the only way to change some of the registers in GRAPHICS 10, a new graphics mode available on Ataris equipped with a GTIA chip.) The numbers in the COLOR column are the values for the COLOR command that will choose that color register to draw with.

The Description column lists which of the three screen elements each color register controls. The first one is the screen background. When the screen is cleared, you are looking at pure background. It is the "canvas" of the screen upon which pixels are plotted and text is printed. Next, there is the border around the background. Although this area sometimes has its own color register (depending on the graphics mode), it is really the "frame"

Mode	Default Colors	SETCOLOR (n)	POKE address	COLOR (n)	Description
GRAPHICS 0 (text mode and text windows for all modes; one hue; two luminances)	Light Blue	1	709	Not normally used	Character luminance (uses same hue as background)
	Dark Blue	2	710		Background
	Black	4	712		Border
ANTIC 4 & 5 (special text modes; five colors)	Orange	0	708	Not normally used	Character
	Light Green	1	709		Character
	Blue	2	710		Character
	Red	3	711		Character
	Black	4	712		Background, Border
GRAPHICS 1 & 2 (large text modes; five colors)	Orange	0	708	Not normally used	Character
	Light Green	1	709		Character
	Blue	2	710		Character
	Red	3	711		Character
	Black	4	712		Background, Border

Table 1 continues on the next page.

Mode	Default Colors	SETCOLOR (n)	POKE address	COLOR (n)	Description
GRAPHICS 3, 5, & 7					
ANTIC E					
(four colors)	Orange	0	708	1	Pixel
	Light Green	1	709	2	Pixel
	Blue	2	710	3	Pixel
	Black	4	712	0	Pixel (Background, Border)
GRAPHICS 4 & 6					
ANTIC C					
(two colors)	Orange	0	708	1	Pixel
	Black	4	712	0	Pixel (Background, Border)
GRAPHICS 8					
(one hue; two luminances)	Light Blue	1	709	1	Pixel luminance (uses same hue as background)
	Dark Blue	2	710	0	Pixel (Background)
	Black	4	712		Border
GRAPHICS 9					
(GTIA mode; one hue; 16 luminances; change hue with SETCOLOR 4, hue, 0 or POKE 712, hue)	Black	4	712	0	Pixel (Background, Border)
	.	—	—	1	Pixel
	.	—	—	2	Pixel
	.	—	—	3	Pixel
	Dark Gray	—	—	4	Pixel
	.	—	—	5	Pixel
	.	—	—	6	Pixel
	.	—	—	7	Pixel
	Gray	—	—	8	Pixel
	.	—	—	9	Pixel
	.	—	—	10	Pixel
	.	—	—	11	Pixel
	Light Gray	—	—	12	Pixel
	.	—	—	13	Pixel
	.	—	—	14	Pixel
	White	—	—	15	Pixel
GRAPHICS 10					
(GTIA mode; nine colors)	Black	—	704	0	Pixel (Background, Border)
	Black	—	705	1	Pixel
	Black	—	706	2	Pixel
	Black	—	707	3	Pixel
	Orange	0	708	4	Pixel
	Light Green	1	709	5	Pixel
	Blue	2	710	6	Pixel
	Red	3	711	7	Pixel
	Black	4	712	8	Pixel
GRAPHICS 11					
(GTIA mode; one luminance; 16 hues; change luminance with SETCOLOR 4, 0, lum or POKE 712, lum)	Black	4	712	0	Pixel (Background, Border)
	Light Orange (Gold)	—	—	1	Pixel
	Orange	—	—	2	Pixel
	Red-Orange	—	—	3	Pixel
	Pink	—	—	4	Pixel
	Purple	—	—	5	Pixel
	Purple-Blue	—	—	6	Pixel
	Azure Blue	—	—	7	Pixel
	Sky Blue	—	—	8	Pixel
	Light Blue	—	—	9	Pixel
	Turquoise	—	—	10	Pixel
	Green-Blue	—	—	11	Pixel
	Green	—	—	12	Pixel
	Yellow-Green	—	—	13	Pixel
	Orange-Green	—	—	14	Pixel
	Light Orange	—	—	15	Pixel

Table 1: The color registers available in each of the Atari graphics modes. For each color register, there is a default color, a value for the SETCOLOR command (SETCOLOR n, hue, lum), an address for the POKE command, a value for the COLOR command (COLOR n), and a general description of how the color register is used. Note that GRAPHICS 9, 10, and 11 are available only on machines equipped with a GTIA chip. ANTIC modes are additional graphics modes that can be set up by creating custom display lists, but are not supported by the Atari operating system.



Photo 1: An example of the default colors used in the GRAPHICS 3 mode of the Atari 400/800.

surrounding the canvas and cannot be drawn on. The "playfield pixels" (any pixel that is plotted with a non-background color register) are last. Each group of plotted points using a specific color register is considered to be a *separate* playfield. For example, look in the table for the section on GRAPHICS 3. Registers 0, 1, and 2 each control the color of playfields 0, 1, and 2, respectively. Register 4 controls the background of the screen and the border (thus, in this mode the background's color cannot be controlled separately from the border's color). Notice that register 4 can also control a pixel; however, this is not a playfield pixel, but a background pixel. Think of plotting with a background color register as *removing* the playfield pixels so that the background color shows through again.

Using the default colors. At first glance, this table may seem somewhat overwhelming. To help you out, let's look at a few examples. Suppose you want to use GRAPHICS 3. Drawings done in this mode have a very coarse resolution of 40 by 24 pixels. The Magic Paint Store owner (i.e., the Atari operating system) was kind enough to fill some of his buckets when he first opened the store. These are called the default colors and can be selected for drawing with the COLOR command. If you wanted to use only these default colors, you can ignore the SETCOLOR and POKE columns because these colors are automatically placed in the color registers when the computer is first turned on or System Reset is pressed. To use the table, first choose a color from the Default Color column, light green, for example. Look across to the COLOR column and you'll find a 2. Therefore, the command COLOR 2 selects the bucket filled with light-green paint.

To place a light-green pixel at 10,8 (x,y), you would execute the following statements:

```
10 GRAPHICS 3+16 : REM Full-screen mode
20 COLOR 2 : REM Choose your bucket
30 PLOT 10,8
200 GOTO 200 : REM Stay in GRAPHICS 3
```

To return to GRAPHICS 0, merely press Break. Note that the full-screen mode is being used (16 is added to the mode number). This means that no text window will be at the bottom of the screen. Try temporarily removing line 200 and see what happens when you run this program. The screen flashes to black, the pixel is plotted, and before you get to look at it, the blue GRAPHICS 0 screen has reappeared. At the end of a program that uses a full-screen graphics mode, the OS will automatically switch back to GRAPHICS 0. Line 200 is added to prevent this from happening until you press the Break button and exit the program.

To draw an orange line across the screen from this light-green dot, add the following lines:

```
40 COLOR 1 : REM Choose another bucket
50 DRAWTO 29,8
```

And now use one more color register available in this mode. This one is filled with blue:

```
60 COLOR 3 : REM One more bucket
70 PLOT 30,8
```

To erase a pixel, choose the background color (which always happens to be COLOR 0):

```
80 COLOR 0 : REM Select background color
90 PLOT 20,8
```

The screen will now look like that shown in photo 1.

Using the SETCOLOR Command

Now that we understand the use of the default colors, let's see what else is available to us. The Atari computer has 16 different hues from which to choose, and each one can be displayed in any of 8 levels of brightness or luminance (16 hues $\times$ 8 luminances = 128 colors). The BASIC command to *change* a color in a color register is

SETCOLOR *n*,*hue*,*lum*

where *n* is the value of the color register chosen from the SETCOLOR column in table 1, *hue* is a number from 0 to 15 that controls the hue, and *lum* is an even number from 0 to 14 (0,2,4, . . . 14) that controls the luminance of the color (the odd *lum* values have the same effect as the next lowest even value; i.e., *lum*=1 and *lum*=0 have the same effect). Table 2 lists the different hues available on the Atari.

Let's look at a few examples to see how the luminance value combines with the hue to instantly produce a new color. Try the SETCOLOR commands in table 3 while in GRAPHICS 0 to change the color of the border (just type them in direct mode). With a little experimentation, you'll be able to produce almost any color you wish.

Now let's have a little fun! Add the following lines to the last program you entered. (Note: All our listings have

been structured for easier reading. FOR-NEXT loops and IF-THEN statements are indented and each statement is printed on a new line. Don't try to enter this structure into your programs, however.)

```

80 COLOR 1          : REM Choose Bucket 1 again
90 PLOT 20,5:
  PLOT 20,6
100 PLOT 19,7:
  DRAWTO 21,7
110 PLOT 19,9:
  DRAWTO 21,9
120 SETCOLOR 1,3,6  : REM Change to Red
130 SETCOLOR 2,12,6 : REM Change to Green
140 FOR I=1 TO 50:
  NEXT I           : REM Pause
150 SETCOLOR 1,0,0  : REM Change to Black
160 SETCOLOR 2,0,0  : REM Change to Black
170 FOR I=1 TO 400
180 IF RND(0)*20<1 THEN
  SETCOLOR 4,0,14:
  SETCOLOR 4,0,0 : REM Random lightning flash
190 NEXT I
200 GOTO 120

```

When you execute this program, you will see a crude airplane heading toward you with red and green lights blinking at the tips of its wings. Every so often, the background will flash as if the plane were flying through a lightning storm.

Lines 120-130 turn on the wing lights. After a pause, lines 150-160 turn them off. SETCOLOR 1 changes the color of the pixel plotted with COLOR 2, and SETCOLOR 2 changes the pixel plotted with COLOR 3. (If this seems a little confusing, refer back to table 1 to see the relationship between the SETCOLOR and COLOR commands.)

If the value of the random number expression on line 180 is less than 1 (1 chance in 20, or 5 percent), the lightning is turned on and off by setting the background color register first to white and then immediately back to black. As you can see in table 1, SETCOLOR 4 controls the screen background.

We could have created the blinking wing lights by replotting the tips with the background color. This technique executes much more slowly than one that changes just the color registers. Although we don't need the speed in this case, the effect would be slightly different. Notice that during the lightning flash the darkened wing lights are silhouetted against the sky. This effect could not be easily duplicated on a computer without color registers.

Using POKEs to Change Colors

Referring back to table 1, you'll notice the POKE column. Each color register has an address in memory associated with it. The value in the color register can be changed by using a POKE command to put a new value into this address. In GRAPHICS 10, the only way to

Hue	Value for SETCOLOR Command (hue)
Gray	0
Light Orange (Gold)	1
Orange	2
Red-Orange	3
Pink (Magenta)	4
Purple	5
Purple-Blue	6
Azure Blue (Cyan)	7
Sky Blue	8
Light Blue	9
Turquoise	10
Green-Blue	11
Green	12
Yellow-Green	13
Orange-Green	14
Light Orange	15

Table 2: The hues available on the Atari 400/800 and their corresponding values to be used in the SETCOLOR command.

Command	Hue	Luminance	Color Result
SETCOLOR 4, 0, 14	Gray	14	White
SETCOLOR 4, 0, 0	Gray	0	Black
SETCOLOR 4, 1, 4	Light Orange	4	Brown
SETCOLOR 4, 1, 12	Light Orange	12	Bright Yellow
SETCOLOR 4, 3, 4	Red-Orange	4	Deep Red
SETCOLOR 4, 3, 12	Red-Orange	12	Flesh

Table 3: Some examples of SETCOLOR commands and the colors that result.

change the values in the first four color registers is with the use of a POKE. To obtain the value to place into a memory location, take the hue value of the color and multiply by 16, then add in the luminance value:

POKE addr, hue * 16 + luminance

In GRAPHICS 7, for example, the following two statements would be equivalent:

SETCOLOR 0,4,8 POKE 708,72

To see why, first find the SETCOLOR 0 row for GRAPHICS 7 in table 1. Then move one column to the right to find the address 708. Multiply the hue in the above SETCOLOR command by 16 ($4 \times 16 = 64$), add the luminance value to it ($64 + 8 = 72$), and you have your POKE value. In many cases, you may want to use a POKE command instead of SETCOLOR because POKE will execute more rapidly. This is because it takes time for BASIC to do the necessary conversion from SETCOLOR's hue and luminance values to a single value that it then puts into the proper address by using POKE. You speed up the process by precalculating the value while you are writing your program. Then, you have

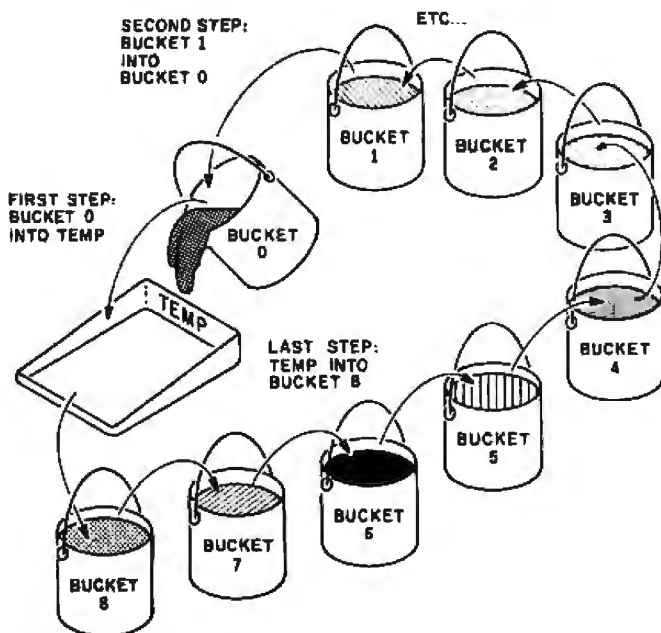


Figure 1: An analogy showing how colors can be rotated through color registers to simulate movement. In this case, paint is transferred from one bucket to another.

BASIC just use POKE to place it in during execution.

This technique can be used to rapidly flash the background when simulating an explosion with the following line:

```
100 FOR I=1 TO 10:
    POKE 712, RND(0)*255:
    NEXT I:
    POKE 712,0: REM Flash background
```

This line selects 10 random colors to flash on the background and then resets the background color to black.

Now type in the following short program and see what happens:

```
10 GRAPHICS 3+16
20 FOR I=0 TO 254 STEP 2 : REM Step through
    every color
30 POKE 712, I : REM Change back-
    ground color
50 NEXT I
60 GOTO 20
```

When you run it, your screen will flash through all the colors so quickly that you will hardly be able to see them. Add the following line to slow it down to human speeds:

```
40 FOR W=1 TO 50:
    NEXT W
```

Try doing this trick without color registers!

Thus, color registers can be used to rapidly change portions of the screen with a simple SETCOLOR or POKE. But what purpose do they serve for animation? Next, the real power of color registers will be explored in two amazing demonstration programs.

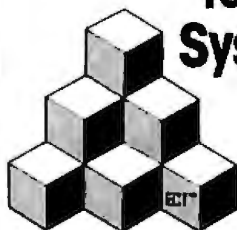
Creating Motion with Color Registers

With careful planning, the ability to change the color of a specific area on the screen instantaneously can be used to create the effect of high-speed motion without resorting to assembly-language programming.

To understand how to create motion using color registers, consider our paint store analogy again. It had nine paint buckets numbered from 0 to 8, each filled with a different color. Now, let's add a temporary paint tray called TEMP. We are going to use the nine buckets and the tray to play "pass the colors" (see figure 1). First, empty the paint contained in Bucket 0 into the temporary tray. Then pour Bucket 1's contents into the now empty Bucket 0. Next, pour the paint in Bucket 2 into Bucket 1. Continue passing the colors until Bucket 8 is emptied into Bucket 7. No more buckets are left with which to fill Bucket 8. Stored in TEMP, however, we still have the paint that first filled Bucket 0. So we take the paint in TEMP and empty it into Bucket 8. Then we go back to the very first step and empty the paint now in Bucket 0 into TEMP (this is called a "bucket brigade" in elec-

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Listing 1: A program in Atari BASIC simulating movement through a Star Wars-like trench. The animation effect is achieved entirely through the use of color-register animation. Note that the listing has been structured for easy reading. When the program is entered into the computer, normal Atari line structures should be used.

```

10 REM      *** THE TRENCH ***
20 REM
30 REM
40 REM Program to create the illusion of flying through a trench by rotating
50 REM the Color Registers in GRAPHICS 7
60 REM Copyright (C) 1982 by David Fox and Mitchell Waite
70 REM
80 GOTO 200
90 REM
100 REM Rotate the Colors
110 SOUND 3,255,0,8: REM Background roar (always on)
120 REM If the trigger on PADDLE 0 is pressed, reverse the direction
130 IF PTRIG(0)=1 THEN
    TEMP=PEEK(710):
    POKE 710,PEEK(709):
    POKE 709,PEEK(708):
    POKE 708,TEMP:
    GOTO 150: REM Not pressed
140 TEMP=PEEK(708):
    POKE 708,PEEK(709):
    POKE 709,PEEK(710):
    POKE 710,TEMP: REM Pressed
150 PDL=PADDLE(0)/5: REM Speed and sound controlled by PADDLE 0
160 SOUND 0,PDL,0,8:
    SOUND 1,PDL*80,0,8:
    SOUND 2,PDL*160,0,8
170 FOR PAUSE=1 TO PDL:
    NEXT PAUSE
180 GOTO 130
190 REM
200 REM Initialize
210 COL=1:
    Y1=45:
    Y2=49
220 REM
300 REM Draw Trench on Screen
310 GRAPHICS 7+16: REM Full screen graphics
320 SETCOLOR 0,3,8: REM Set Color Register values
330 SETCOLOR 1,3,8
340 SETCOLOR 2,3,4
350 FOR X=2 TO 79: REM Increment horizontal coordinates
360   COLOR=INT(COL*0.5): REM Choose which Color Register to draw with
370   PLOT X+80,Y1:
    DRAWTO X+80,Y2:
    DRAWTO 79-X,Y2:
    DRAWTO 79-X,Y1
380   Y1=Y1-0.6:
    Y2=Y2+0.6: REM Increase vertical line length
390   IF Y1<0 THEN
    Y1=0: REM Prevent overflow
400   IF Y2>95 THEN
    Y2=95
410   COL=COL+(79-X)/160: REM Increment Color Register
420   IF COL*0.5>=4 THEN
    COL=COL-3
430 NEXT X
440 GOTO 100

```

tronics). We have just created an endless loop of moving colors that is seen on the screen as a rapidly changing pattern. Depending on what was drawn and how it was organized on the screen, a hypnotically abstract design or an exciting, realistic scene can be produced.

As animators, we must now "form" this pattern of moving colors into something interesting to look at.

The Trench Program

Everyone who saw the first *Star Wars* movie remembers the flight through the Deathstar's trench. In the next program, listing 1, we will use color-register animation to create this effect. We will be using GRAPHICS 7, which has a resolution of 160 by 96 and uses four color registers.

Our goal will be to draw a trench on the screen in GRAPHICS 7 in such a way that the viewer will have the experience of rapidly traveling through it (see photo 2). The trench will be U-shaped with two vertical sides and a horizontal bottom. Using a game paddle, the viewer will have control of speed through the trench and for-

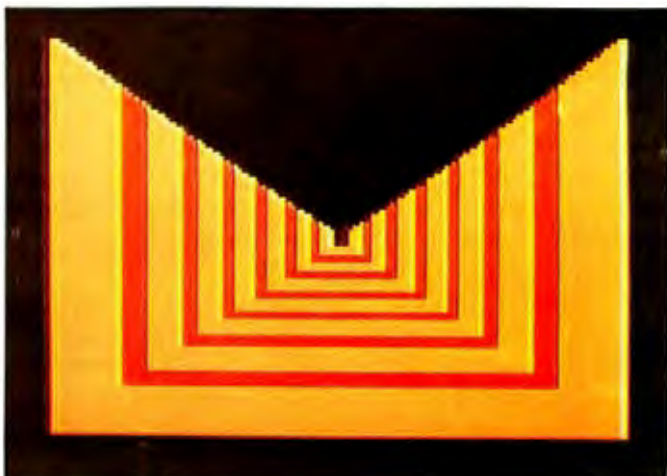
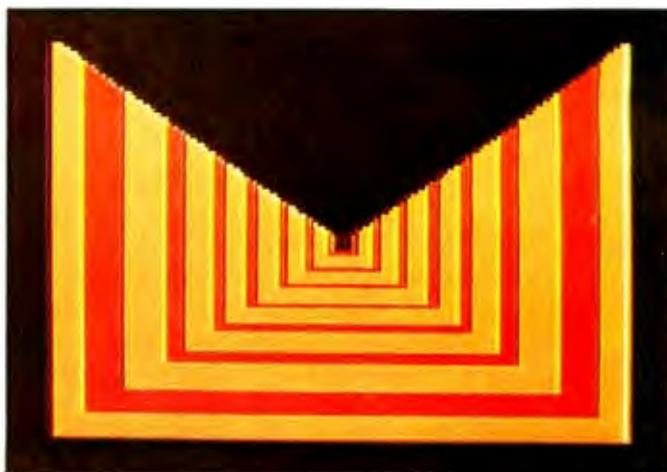
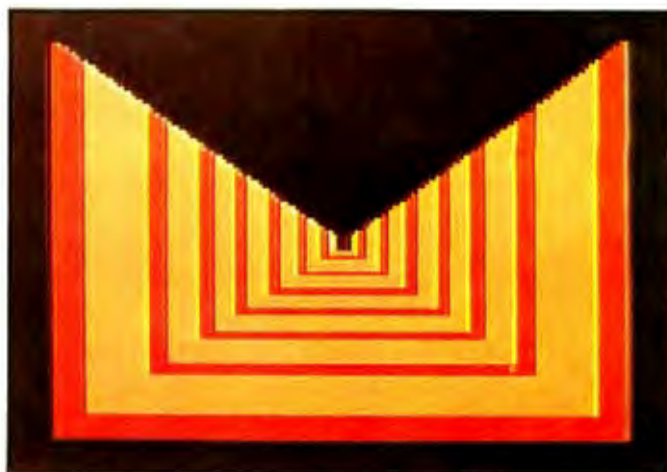


Photo 2: Three displays generated by the program in listing 1 entitled "The Trench." The effect of movement is achieved by rapidly cycling two colors through three registers.

ward/reverse motion. The roar of the engines will change as the velocity changes. This program could be the core of an exciting game.

This program has three main sections: the initialize section, the section that draws the trench on the screen, and the section that animates the picture by rotating the colors and reading the game paddle. You'll notice that this

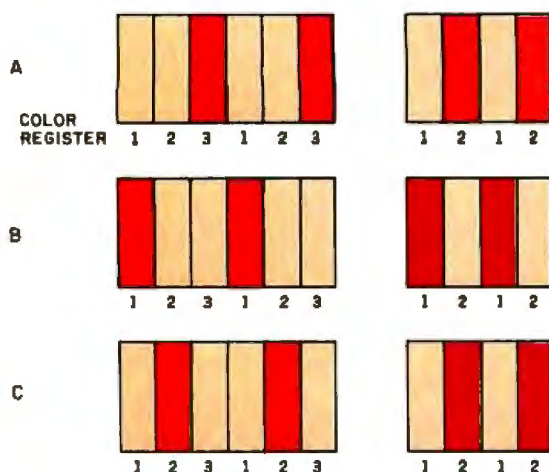


Figure 2: Simulating movement by rotating two colors through three color registers. The use of three color registers (on the left) results in a smooth animation effect. If only two color registers are used (as on the right), there is just a flickering effect.

last section was placed at the beginning of the program. It makes use of the fact that statements toward the beginning of an Atari BASIC program are executed at a faster rate than those at the end.

The drawing section was the hardest for us to write. It took quite a while to create a formula that could simulate the perspective of the trench. We could have drawn the trench on paper and just translated the plotting coordinates to the program, but that would have used much more memory.

Initialize (listing 1, lines 200-220). The initial values are set along with the colors to be drawn. Notice that two of the registers are set to the same color. Even though we are using three color registers in our animation sequence, only two colors will be passed through them. This yields a smoother animation effect (see figure 2). The three boxes, A, B, and C, show the progression of the two colors through the three registers. Even though the width of one of the moving colors is two bars wide, the step size of the movement is only one bar wide.

If only two colors and two registers were used, the viewer would just see the two colors alternating places. There wouldn't be any illusion of movement, just a flickering effect. With three colors and three registers, there would be too many colors in the trench and the effect would be spoiled.

Drawing the trench (lines 300-440). This section draws the trench on the screen using the appropriate color register. We start near the horizon, draw the three sides of the trench, and then move out toward the edges of the screen. The algorithms used here were all arrived at through trial and error. Line 370 increments the value of C in smaller and smaller steps as X (the horizontal position of the lines) increases. This creates the illusion of perspective—the closer the different-colored panels are to the viewer, the wider they appear.

Rotating the colors (lines 100-180). This program calls for sound effects and an element of interactivity.

The GTIA and CTIA Chips

When the Atari computer first came out, it had a special television interface chip called CTIA. Beginning in early 1982, all Ataris were manufactured with a new and better chip called GTIA. The GTIA supports three additional BASIC graphics modes, 9, 10, and 11, which were not available on the earlier Atari computers. The resolution on these modes is 80 by 192, yielding the same vertical resolution as GRAPHICS 8 (as well as the same memory consumption), but a much coarser horizontal resolution. GRAPHICS 9 allows the selection of one hue that can then be simultaneously displayed on the screen with 16 different luminances. GRAPHICS 11 allows the placement of up to 16 different hues on the screen, all set to the same luminance value. These two modes are not covered in the article because they can't be used for color-register animation. We do discuss GRAPHICS 10, however, which allows you to choose any nine colors from the Atari palette of 128 colors.

To tell whether your Atari has the CTIA or GTIA chip, enter and run the following program:

```
10 GRAPHICS 10
20 GOTO 20
```

If your screen first flashes black and then returns to blue, you have the CTIA. The program will still be running, but the CTIA chip will not be able to display a GRAPHICS 10 screen. If your screen stays black, congratulations! You have the GTIA and can run the Fall Waterfall program. If not, you can get your computer upgraded to the GTIA chip for a small fee. If you don't do this, you will miss out on many new Atari programs that require this chip.

Sound register 3 is used to give a constant background roar (line 110). The game paddle is used to control the speed through the trench (line 150) and to reverse the direction we are traveling (line 130). If the paddle button is pressed, we move backward (line 140). The POKes in lines 130-140 could have been replaced with a FOR-NEXT loop that would have placed in each color register the contents of the next higher (or lower) color register, but this would have required much more execution time. In line 160, the position of the game paddle is also used to control the pitch of the other three sound registers. To add to the realism, the whine of the engine rises in pitch as velocity increases. Line 170 takes the paddle value and uses it to control a pause loop.

If you don't have game paddles, use a joystick to change the value in PDL. If the joystick is pushed forward, increment PDL; if it is pulled back, decrement PDL.

Now, moving from the excitement of outer space, we will visit a sylvan scene of the wilderness.

The Fall Waterfall Program

In this program, we will use GRAPHICS 10, the new graphics mode that is especially suited for color-register animation, as it allows us to use all nine Atari color registers (see the text box on the GTIA and CTIA chips).

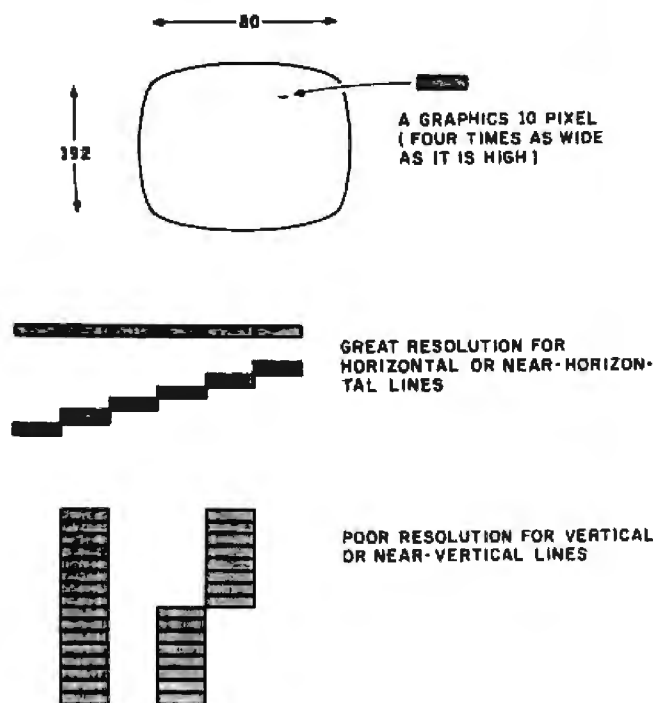


Figure 3: Diagram illustrating the pixel shape in GRAPHICS 10, a new graphics mode (GTIA) for the Atari 400/800.

We will draw an autumnal landscape complete with trees casting long shadows from an early morning sun. The scene is brought to life by a foaming waterfall cascading down a steep cliff and across a green valley.

Using the Amazing GRAPHICS 10

GRAPHICS 10 has a rather strangely shaped pixel (see figure 3). Each pixel is about four times as wide as it is high, with a screen resolution of 80 by 192, making it awkward to use when drawing curved surfaces. As you can see in the figure, lines that are almost horizontal show very fine resolution, and those that approach vertical are extremely coarse.

To change the values in the color registers for the standard CTIA graphics modes (0 through 8), you can use the SETCOLOR command. However, Atari BASIC isn't fully set up for the GTIA graphics modes. The only way to change the colors in the first four color registers of GRAPHICS 10 is by using POKE to put them directly into the color register's RAM (random-access read/write memory) address. Table 1 shows the relationship between this RAM address and the SETCOLOR command. Even though BASIC's SETCOLOR isn't adequate in GRAPHICS 10, BASIC's COLOR command *can* be used to choose any of the registers for painting. For example, to draw orange (hue 2, luminance 8) pixels on the GRAPHICS 10 screen with register 1, use the following statements:

```
POKE 705,40 : REM Fill register 1 with orange
              (hue=2, lum=8)
COLOR 1      : REM Select register 1 for
```

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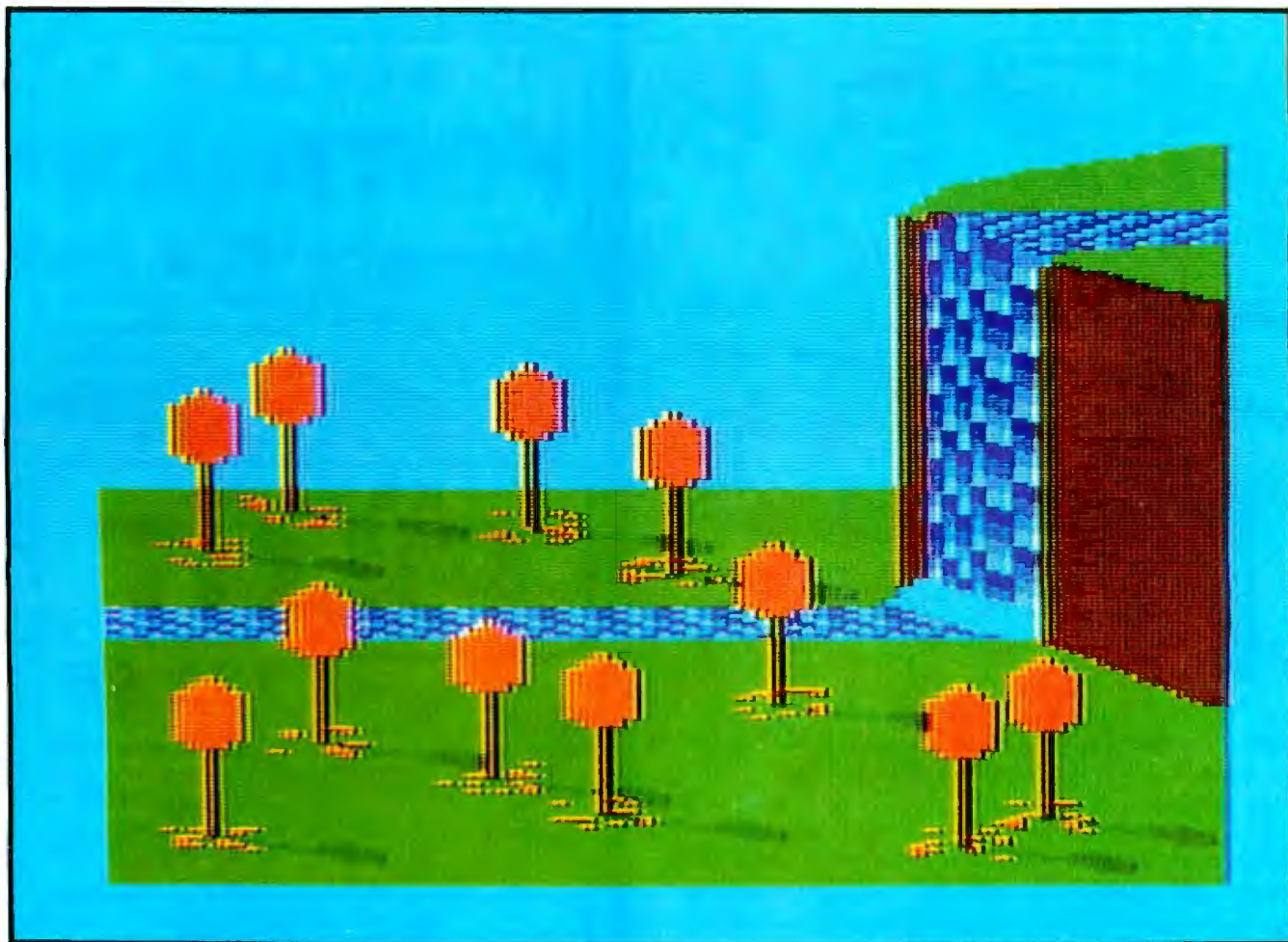


Photo 3: An autumnal waterfall scene produced by the program in listing 2. The effect of moving water is produced by cycling different shades of blue through the color registers.

drawing
PLOT X,Y : REM Place an orange pixel at
X,Y

To draw with register 6, you could use either the SET-COLOR command or a direct POKE:

SETCOLOR 2,2,8 or POKE 710,40

Because of the complexity of our autumnal waterfall scene (see photo 3), this program is quite a bit longer than the last one. The section that actually animates the scene, however, is only three lines long. This reveals that much of our Atari animation involves "setup," whereas the actual "motion code" is simple.

Even though we have nine color registers to play with on a GTIA Atari, we seldom use *all* of them for color rotations in an animated scene. Only four color registers will be used for the program's animation. The other five registers will be used to draw the landscape. This takes some planning because there is an interdependency between what we want to include in the picture and how many colors can be used. One way to plan the picture is to keep adding details as long as colors are left. That's the method we used. The background register was used for

the sky, another register for the brown cliffs, and a third for the grass covering the top of the cliff and the valley floor. Since that left two unused registers, we planted trees across the valley floor. The brown of the cliffs was also used for the trunks of the trees, and the treetops were painted orange-red to add some color. Finally, a darker shade of green was used in the last register for tree shadows. The foam at the base of the waterfall was drawn with the sky's color rather than one of the waterfall's colors, because we didn't want its color to change at all. No more registers were left for new colors. Therefore, the scene was completed.

To make it easier to color large areas of the screen rapidly, the Atari operating system's built-in "Fill" routine is used. Unfortunately, this Fill is not the same as the FILL or FLOOD used in professional computer paint systems. Atari's Fill will not seek out all the adjacent nooks and crannies within the area to be filled. Since it's more of a "box" fill, it just draws a series of horizontal lines toward the right of the screen. Each line is completed when it hits a nonbackground color. Even worse is the fact that there is no simple Atari BASIC statement to implement this routine (although there is a FILL statement in Atari Microsoft BASIC). Instead, we must use a special call to the OS (using the XIO command) to ac-

tivate Fill after setting up the screen in a particular way. This makes it very inconvenient to use, but it's still better than nothing. (For more information on how Fill works, see *Computer Animation Primer* or the Atari BASIC manual.)

This program has only three main parts: initialize, draw the scene, and animate the scene. Because the program is longer than the earlier one, however, we divided the drawing portion of the program into several smaller sections (see listing 2).

Initialize (listing 2, lines 200-310). Here we set up the palette of colors we will be using.

Drawing the grass and cliff (lines 400-490). As in oil painting, we must first paint in the large background areas, then the details. We are using the Fill routine to rapidly color these large areas. To make this process

simpler, a subroutine on lines 1300-1310 is used, which carries out the Fill routine described earlier.

Drawing the falls and river (lines 500-820). In our scene, the water is the only thing that is animated. Four color registers are used to animate the moving water. The water is drawn in three sections: the river on top of the cliff (lines 510-600), the waterfall (lines 610-720), and the river on the valley floor (lines 730-820). The water consists of a series of parallel strips. To give some randomness to these strips, a subroutine (lines 1500-1530) is called that chooses the starting color register for each strip of water, making sure that no two adjacent strips will have the same colors. On lines 710-720, some grass and dirt are added around the falls to depict the natural forces of erosion.

Drawing the trees (lines 900-1070). This section draws

Listing 2: A program in Atari BASIC for generating an autumnal scene with an animated waterfall. Note that a GTIA chip is needed to run this program and that the listing has been structured for easy reading.

```

10 REM *** FALL WATERFALL ***
20 REM
30 REM
40 REM Demonstration of animating a scene by rotating the Color Registers
50 REM (Uses GRAPHICS 10 - GTIA is needed)
60 REM Copyright (C) 1982 by David Fox and Mitchell Waite
70 REM
80 GOTO 200
90 REM
100 REM Rotate the Colors
110 TEMP=PEEK(705):
POKE 705,PEEK(706):
POKE 706,PEEK(707):
POKE 707,PEEK(708):
POKE 708,TEMP
120 FOR WT=1 TO 3:
NEXT WT
130 GOTO 110
140 REM
200 REM Initialize
210 FILL=1300
220 GRAPHICS 10
230 POKE 704,9*16+10: REM Sky - COLOR 0
240 POKE 705,8*16+10: REM Water - COLOR 1
250 POKE 706,8*16+8: REM Water - COLOR 2
260 POKE 707,8*16+6: REM Water - COLOR 3
270 SETCOLOR 0,8,4: REM Water - COLOR 4
280 SETCOLOR 1,12,4: REM Tree shadow - COLOR 5
290 SETCOLOR 2,2,4: REM Cliff & tree trunks - COLOR 6
300 SETCOLOR 3,12,6: REM Grass - COLOR 7
310 SETCOLOR 4,3,6: REM Treetops - COLOR 8
320 REM
400 REM Draw Grass and Cliff
410 COLOR 7:
POKE 765,7: REM The grass
420 PLOT 79,10:
DRAWTO 79,45:
X1=78:
Y1=10:
X2=66:
Y2=15:
GOSUB FILL:
430 X1=65:
Y1=15:
X2=61:
Y2=18:
GOSUB FILL:
X1=60:
Y1=18:
X2=56:
Y2=25:
GOSUB FILL:
440 X1=56:
Y1=25:
X2=65:
Y2=35:
GOSUB FILL:
X1=66:
Y1=35:
X2=78:
Y2=45:
GOSUB FILL:
450 COLOR 6:
POKE 765,6: REM The cliff
460 PLOT 79,46:
DRAWTO 79,145:

```

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Listing 2 continued:

```

X1=54:
Y1=26:
X2=54:
Y2=117:
GOSUB FILL
470 Y1=117:
X2=68:
Y2=132:
GOSUB FILL:
X1=68:
Y1=132:
X2=78:
Y2=145:
GOSUB FILL
480 COLOR 7:
POKE 765,7: REM More grass
490 PLOT 0,191:
DRAWTO 79,191:
DRAWTO 79,146:
X1=0:
Y1=191:
X2=0:
Y2=91:
GOSUB FILL
500 REM Draw the Falls and River
510 FALL=58:
CFLAG=0: REM Draw the river on top of the cliff
520 FOR Y=25 TO 34
530 GOSUB 1500
540 FOR X=79 TO FALL STEP -1
550 COLOR COL
560 PLOT X,Y
570 COL=COL-1:
IF COL=0 THEN
COL=4
580 NEXT X
590 FALL=FALL+1
600 NEXT Y
610 FALL=0:
CFLAG=-1: REM Draw the falls
620 FOR X=58 TO 66
630 FALL=FALL+1
640 GOSUB 1500
650 PLOT X,25+FALL
660 FOR Y=30 TO 120 STEP 4
670 COLOR COL
680 DRAWTO X,Y+FALL
690 COL=COL-1:
IF COL=0 THEN
COL=4
700 NEXT Y:
NEXT X
710 COLOR 6:
PLOT 58,28:
DRAWTO 58,25:
DRAWTO 59,25:
PLOT 66,38:
DRAWTO 66,129: REM Cleanup
720 COLOR 7:
PLOT 73,33:
DRAWTO 79,33:
PLOT 68,34:
DRAWTO 79,34
730 FALL=57:
CFLAG=1: REM Draw the river on the valley floor
740 FOR Y=121 TO 128
750 GOSUB 1500
760 FOR X=FALL TO 0 STEP -1
770 COLOR COL
780 PLOT X,Y
790 COL=COL-1:
IF COL=0 THEN
COL=4
800 NEXT X
810 FALL=FALL+1
820 NEXT Y
830 REM
900 REM Draw the Trees
910 FOR T=1 TO 11
920 READ X,Y
930 COLOR 8: REM Tree top
940 FOR I=0 TO 2:
PLOT X-I,Y-40+2*I:
DRAWTO X-I,Y-20+2*I:
NEXT I
950 FOR J=-2 TO -1:
PLOT X-I,Y-40+2*I:
DRAWTO X-I,Y-20+2*I:
NEXT I
960 COLOR 6: REM Tree trunk
970 PLOT X,Y:
DRAWTO X,Y-21
980 COLOR 5: REM Shadow of tree
990 PLOT X,Y+1:
DRAWTO X+7,Y+4:
PLOT X+8,Y+3:
DRAWTO X+8,Y+5:
DRAWTO X+9,Y+6:
DRAWTO X+9,Y+3:
DRAWTO X+10,Y+3:
DRAWTO X+10,Y+7
1010 PLOT X+11,Y+7:
DRAWTO X+11,Y+4:
DRAWTO X+12,Y+5:
DRAWTO X+12,Y+7
1020 COLOR 8: REM Fallen leaves around tree trunk
1030 FOR I=1 TO 15
1040 RX=X+INT(RND(1)*7)-3:

```

```

IF RX=X THEN 1040
1050 RY=Y+INT(RND(1)*8)-3:
PLOT RX,RY
1060 NEXT I
1070 NEXT Y
1080 REM
1100 REM Draw the Foam
1110 COLOR 0: REM Same color as the sky
1120 PLOT 57,114:
DRAWTO 65,122
1130 PLOT 57,115:
DRAWTO 65,123
1140 PLOT 57,116:
DRAWTO 65,124
1150 PLOT 56,116:
DRAWTO 65,125
1160 PLOT 56,117:
DRAWTO 65,126
1170 PLOT 56,118:
DRAWTO 65,127
1180 PLOT 56,119:
DRAWTO 65,128
1190 PLOT 55,119:
DRAWTO 64,128
1200 PLOT 55,120:
DRAWTO 63,128
1210 REM
1250 REM Turn on the Sound
1260 FOR I=0 TO 3:
SOUND I,1*50,0.8:
NEXT I
1270 GOTO 100
1280 REM
1300 REM Fill Subroutine
1310 PLOT X1,Y1:
POSITION X2,Y2:
XTO 18,86,0,0,"S":
RETURN
1320 REM
1500 REM Choose Color
1510 COL=INT(RND(1)*4)+1:
IF COL=STARTCOL THEN 1510: REM No two adjacent strips with same color pattern
1520 STARTCOL=COL+CFLAG: REM Calculate next starting color to avoid
1530 IF STARTCOL=0 THEN
STARTCOL=4
1540 IF STARTCOL=5 THEN
STARTCOL=1
1550 RETURN
1560 REM
2000 REM Data for Location of Trees
2010 DATA 7,106,13,96,30,100,40,112,47,145,7,179,15,155,27,164,35,173,60,181,66,174

```

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11 identical trees. The x and y "base" coordinates for the trees are stored on line 2010. An x, y coordinate pair is read and a new tree is drawn at that location. Lines 980-1010 add realism by creating a shadow in a darker shade of green. Lines 1020-1060 create some randomness by scattering 15 leaves about the base of each tree.

Drawing the foam (lines 1100-1200). As the water hits the base of the falls, white foam is created. Since no color registers are left for white foam, the sky color is used again.

Turning on the sound (lines 1250-1270). All the sound registers are used to create the roar of the waterfall. The sound is constant and does not need to be changed.

Rotating the colors (lines 100-130). This section is similar to the corresponding sections in the other program. Of course, we need to rotate only the color registers for the four colors of the water.

Modifications. We can also modify the scene by doing the following:

- Simulate a sunset by gradually changing the sky color to orange, pink, and purple, and by decreasing the luminance values of each of the color registers. Then, after a period of time, we can reverse the process for a sunrise.
- Change this program into a representation of the different seasons of the year. Simply by changing the colors in the appropriate registers, you could turn this into a

summer scene (i.e., by turning the treetops green). And by altering the color of the grass and treetops to white, the sky to gray, and slowing or stopping the flow of the river, you can create a winter scene.

Summary

The increase in performance from pixel-to-pixel mapping to color mapping using color registers is an enormous one. Animation and special effects never before thought possible can now be accomplished on personal computers with very few program statements. As we have shown with our Trench program, color mapping makes it possible to create dramatic motion effects and perspective changes, similar to those used in arcade games, on a low-cost computer like the Atari 400/800. Furthermore, for the Chagalls and Rembrandts of the world, wonderful and complex background scenes can be brought to life with just the briefest of program statements (as witnessed by the Fall Waterfall program). But we have only scratched the surface of the Atari's animation power. User-definable character sets, player-missile graphics, fine scrolling, vertical-blank interrupts, and display-list interrupts can be combined with color mapping to give the Atari a performance edge that will probably never be equaled (except by Atari). The book *Computer Animation Primer* provides much detailed information for anyone interested in learning more about these computer-animation techniques. ■



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Chuck Peddle

Chief Designer of the Victor 9000

A candid discussion on microcomputer design, marketing, and the industry's future.

Phil Lemmons
West Coast Editor

More than any other person, Chuck Peddle deserves to be called the founder of the personal computer industry. After getting a bachelor of science degree in engineering physics in 1959, he worked for 11 years for General Electric in all aspects of its computer enterprises. In 1970, Peddle started a company to make intelligent terminals. "Too early," he now says. He started a word-processing company in 1972. "Too early," he now says. He then went to work for Motorola, where he participated in the design of the 6800 microprocessor family. Peddle did the architecture for all the peripheral chips of the 6800 and all the I/O (input/output) structure. The 6820, a peripheral interface adapter (a parallel I/O chip), secured several fundamental patents in that area.

Peddle took a team from Motorola to MOS Technology in 1974 to do a low-cost microprocessor and was chief architect in the design of the 6502 microprocessor and its family of chips. By producing the 6502 and selling it for only \$25 while other semiconductor houses were saying the price would never fall below \$200, Peddle made the personal computer possible.

The 6522, the PIA (peripheral in-

terface adapter) in the 6502 family, extends the concepts in the 6820 by adding some integral timers and shifters as well as other features. The 6522 appears in several places in the Victor 9000 (see "Victor Victorious," page 216 of this issue).

MOS sold 6502s to Atari and Steve Jobs, and then Commodore bought MOS Technology. Peddle transferred to the West Coast and started Commodore's systems business. At Commodore, Peddle developed the world's first personal computer, which he designed to Radio Shack's specifications. In January 1977, Peddle showed the first PET to Radio Shack at the Consumer Electronics Show. Radio Shack and Commodore were unable to make a deal. Radio Shack did its own microcomputer. Commodore brought out the PET, and Steve Wozniak made the 6502-based Apple II. The PET and the Apple II were simultaneously announced to the public in 1977 at the West Coast Computer Faire. Apple shipped Apples first, but Commodore showed the PET first.

Peddle has since left Commodore, founded Sirius Systems Technology, and designed the machine sold in North America as the Victor 9000 and

elsewhere as both the Victor 9000 and the Sirius 1. BYTE's West Coast editor, Phil Lemmons, interviewed Peddle late in July 1982 about his goals in designing the Victor 9000/Sirius 1 and about the direction of the microcomputer industry in the next few years.

PL What were your general goals in designing the Victor 9000/Sirius 1?
Peddle I think there were three generations of microcomputer products. The first generation was the board-level computer, like the KIM-1, which was the thing that we did at MOS Technology, the Apple I, the Systems Group—that kind of computer. They were really hobby computers, meant to be used by people looking to develop computer skills.

The second generation—the PET, the Apple II, the TRS-80—were designed as stand-alone, plug-'em-in-and-they-work computers for people who wanted to have computers of their own, for whatever reason. The evolution of that kind of product into high memory, disks, and so forth, leads you to see that those products, which had really been conceived for a different purpose, were starting to be

used heavily in business, where they really had a lot of limitations.

PL Forty-column screens, that sort of thing?

Peddle Well, just the whole concept. They were aimed at a different market. If you look at the VIC-20, it is really the original PET repackaged at a lower price—that kind of thing.

We believed that a third generation of microcomputer was coming that would be compiler-oriented, would have multiple high-capacity disks, lots of compute power, synchronous communications, and high-resolution screens, a product that would be designed to be used as a desktop machine in an office network. It was going to be used professionally. It was an office product as opposed to these other products.

We felt that several developments—the new architectures of new micros, the dropping prices of 64K-bit RAM [random-access read/write memory] chips, what had happened in floppy-disk capacities, what was going to happen in hard disks, what was going to happen in networks—basically gave us the opportunity to design a new generation of product. So the goal for the Victor 9000/Sirius 1 was to have a true, very competitive, desktop, entry-level product that could be marketed by the office-products dealers but would also be sold by a sophisticated computer dealer as really a replacement for the higher-end applications of the personal computers and the lower-end applications of the pseudominis and minis. That's a very crisp market



Chuck Peddle

definition, a very crisp generation definition.

PL How long did the design of the computer take?

Peddle We fundamentally formed the design team in late December of '80 and started operations in January '81. We showed the first prototype product in April of '81.

PL How many people were on the design team?

Peddle Basically about eight people. It grew after that as we built things.

PL What processors did you consider and why did you choose the 8088?

Peddle We looked at the dual 6502, which was fine except there was no programming base—a small base in Europe, but none in the United States. We looked at 6502 and Z80 combinations, which would have given us an Apple look-alike and a CP/M look-alike. But we concluded that the memory-management prob-

lem, while it was solvable, would lead to the sort of machine from which a software base would not naturally evolve. If we were a world leader, like DEC or some firm like that which has its own proprietary software, it might be worthwhile. But these two approaches wouldn't satisfy our software needs.

We then looked at the Motorola 68000. You know, even though I'd been with the Motorola family from almost the beginning, the conclusions were that product was never going to be as cost-effective as the Intel 8086 family was going to be, the

support languages were not there at the time, and the 8088 was a very interesting alternative to the 8-bit micros, which we felt we had to compete against from a cost standpoint, but the 8088 also had the ability to migrate upward into 16-bit software.

PL Is there an 80286 [Intel's new very high performance version of the 8086] in your future?

Peddle There's anything that Intel does in our future.

PL The standard memory in the Victor 9000 is 128K bytes. Is that true of the Sirius 1 too?

Peddle Yes, the Sirius and the Victor both. The business strategy for that is very simple. Victor was literally with us from the time we started Sirius Systems Technology. The company was a partnership. We talked to Victor within a week after we formed the company—

PL It's more than the traditional OEM relationship?

Peddle That's right. Victor and Sirius were partners right at the beginning. We talked about the concept. Our business strategy was to compete for Victor's business with Japanese companies, giving Victor the same kind of pricing they would have gotten out of the Japanese. Letting them build a volume base for us in the United States, while we, because of our special knowledge of the international market, would concentrate outside the United States market. We were trading volume for specialized market, in this case, to get higher profit margins. The decisions that went into the computer design were always based on this premise. Therefore, the boards in the Victor 9000 and the Sirius 1 are the same, the power supplies are the same. It's basically the industrial design that's different.

PL The 128K bytes of standard memory was a huge amount a year

ago, and it's still a lot, for standard equipment. But now that memory's gotten much cheaper, are you thinking of adding more memory in order to take advantage of the new operating system improvements that I keep hearing about?

The Victor 9000 has the smallest footprint of any word processor.

Peddle Remember two things. First of all, we offer the most memory expansion in the market.

PL Something like three quarters of a megabyte?

Peddle It's more than that, it's really over 900 kilobytes. We have announced a 256K version of the machine that we're currently supply-

ing with a 128K expansion. We're shipping all of that expansion product, and so the answer is that we see an evolution for the development machines almost exclusively to 256K, and some level of application machines to 256K. You've got to watch it. The market's such that when you have to compete against the Z80 and 6502 machines, you've got to be careful not to have too much in your baseline machine when you have to go in—at least on a price-quote basis—against these machines with a lot less capability, and we're able to come close in price.

PL After you decided you wanted to have something in the range of 1.2 megabytes of floppy storage, why did you choose 5¼-inch drives instead of 8-inch?

Peddle Cost, packaging. The Victor 9000 has the smallest footprint of any word processor in the marketplace, much less any personal computer.

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PL And that couldn't be done with 8-inch thin-line drives?

Peddle No. The form factor on that design was very, very compact. It was designed to sit on the side port of a secretary's desk. Remember our primary market is Europe, and Victor wants to be a factor in that market too, and therefore we had to meet the latest European ergonomic standards. Packaging 5¼-inch drives led much more easily to that. Typically 5¼-inch drives are cheaper by far. We believed that we could pack the 5¼, and we could get enough capacity into that size on the basis of techniques that we'd used previously. And we were able to do so without any sacrifice of system reliability. In fact, we have a more reliable system. We've done some tests on alignment. We're less sensitive to alignment problems than normal 48-tpi (tracks per inch) drives.

PL I had the machine for several months, longer than I intended, for several reasons. I tried to do things with huge files to cause problems, and I haven't been able to generate a single disk error. So I'm convinced.

Peddle Yes, if you look at the way we've done it, the systems concept is much more inherently reliable. We've got a very tuned phase-locked loop, which we're operating very effectively at a single frequency, but we have none of the normal droop and signal-to-noise problems that most disk drives have because we're really recording at constant density all the way across the disk.

PL The constant linear speed is a factor too?

Peddle Right. The combination of the phase-locked loop and the constant linear speed is unique.

PL In order to include these two characteristics, did you have to design your own disk-controller board?

Peddle Perhaps, but quite frankly, the system is optimized for cost as well as performance. We get higher-capacity disks and higher-resolution

screens. We consider our forte to be systems design. That's what we are—systems designers, systems architects, as opposed to just logic people. We have a mixture in our company of big computer people and microcomputer people, specifically for the purpose of doing a better job of systems architecture from the top down.

PL Why did you use the 6522 parallel I/O chips for the disk-controller board and other input/output? Specific design virtues?

Peddle Yes, basically. We used them for some things we do with printers and particularly for our parallel ports. Look at the way we did our IEEE or printer port. We needed to have the ability for our I/O devices to be glitchless when we change states and directions. Intel parts aren't. Motorola parts and MOS Technology parts are, because we designed

them that way. By the way, I used Intel parts to begin with. Had to redesign.

PL Why did you choose Group Code Recording [a technique of compressing data by squeezing out zeros] as a method for increasing disk-storage capacity? Were there other options?

Peddle No. We proved to ourselves long ago that Group Code, with the higher bit densities and the kind of recording scheme we had, gave a much more reliable recording. It's a question of reliability as much as it is higher capacity.

PL Is the encoding itself done in the BIOS [basic input/output system]?

Peddle No, it's done in the disk-controller chip that does the speed control, and yeah, there's a small amount in the programming. The system is really a combination of

micro- and multiprocessing, if you will. Some pieces of the stuff are done in the chip itself. Some of it's done in a ROM [read-only memory] that's outboard—it's currently being implemented into a gate array—and some of it's done in the outboard micro that's in the controller. So it's—I don't like to overuse the term "systems design," but in fact that's what it is. It really is a totally integrated design. You partition pieces of it but the focus is constantly architecture.

PL The high-resolution monitor is one of the computer's most striking features. A lot of computers now have separate RAM for the screen. Your computer has some screen RAM, but it also gives the monitor access to main memory. Why did you choose that approach?

Peddle First, cost. Second, programming ease—the ability to move

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memory around for some of the high-resolution kinds of things we do. Third, it's a trade-off. You can use character graphics part of the time and give yourself back about 40K of memory. If you want to go into high-resolution mode, you give up that memory. So it's an architectural decision. The only memory we have out-board is there because for timing purposes we needed another memory. We're already really doing a 32-bit fetch for the screen right now. We needed some parallel memory in order to be able to do that.

PL Why the Hitachi 46505 CRT-controller chip?

Peddle It's a third-generation computer. Therefore we were looking at a state-of-the-art product that was just coming out. Look at what we did with the CODEC [coder-decoder for digitized voice]. Look at what we did with the communications chips. We

were looking for the thing that was the best product at that point in time, even though the price was high, because we felt that we didn't want to redesign later. So we went with the best ICs we could get, under the assumption that the price would drop.

PL For the RS-232C serial ports, you chose the 7201 programmable communications chip. I know one programmer who's been singing its praises as something to use in writing communications software. But why that particular chip?

Peddle We felt that you needed a channel of synchronous communications. The 7201 gives us two channels, totally under program control.

I want to contrast what we consider different in the third generation from the second generation. Second-generation computers were basically ROM-based machines, right? They

were designed to power up, run, and go. They were designed to be used by fairly trivial programmers to write simple programs. What we discovered was that all those architectures kept getting in the way of the more sophisticated programmers. On this machine, we felt that almost all programs would be written by sophisticated applications programmers, and you would have a higher level of operating languages and utilities. And, therefore, we wanted to make the machine absolutely as soft as we could, so that programmers could just get in and do anything. The keyboard is an example of that. The whole concept of the keyboard is to allow universal configurability by the programmer so that you can have a machine that is so personalized that the user buying the product believes he is buying a unique product. What he's really buying is a general-purpose piece of hardware, which we

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built, and a very sophisticated, specialized piece of software written by a creative programmer who's solving that particular problem. But if those are married and properly packaged and presented to a user, he'll believe this machine is tailored for him, whereas you couldn't do that with products from the previous generation.

So the whole idea was to put enough hardware in the machine—the communications chip, pro-

grammable data rates, and so on—to stay out of the programmer's way.

PL I guess there's no reason why the keyboard couldn't be switched to a Dvorak format?

Peddle Absolutely. Whatever you want. Have fun.

PL Is anyone doing it yet?

Peddle No, we haven't seen anybody do it, but we're already supporting 31 different keyboard styles.

We intend to support as many keyboards as people want to create.

PL The 8048 microprocessor seems to be a popular choice for keyboards, but it's really a general-purpose microprocessor isn't it? What suits it especially to scanning and so on?

Peddle It's available from Intel, and it's quite reasonably priced. You know, there are a couple of others that were probably equally doable, but I think the answer is really that it's an Intel product.

PL What applications did you have in mind for the CODEC voice capability?

Peddle It's our belief that machines in the business environment are going to have to become increasingly user-friendly. That's the reason for the high-resolution screen. If we could do it, voice input would be in the product right now. It will be if it ever becomes available. You could buy a Datsun 280 ZX that has a pretty voice to tell you the door is open. You're going to be able to buy a refrigerator that will talk to you before long. We believe voice is the competition that the Japanese have chosen for the next generation of consumer products. We feel that the use of the voice to personalize training, to interrupt for electronic mail, is something that will be required by customers in the near future. High-resolution graphics on the Apple II showed us something about what this marketplace is all about. On the PET, we put in character graphics because it was cheap and it was available. We won design awards with the PET character graphics because the average programmer could jump all over them and was made happy quickly. In the long run, the Apple graphics won because more creative programmers could do more with that product, to the point that we felt that a next-generation product couldn't *not* have high-resolution graphics. We think voice fits the same category, that by making it available, we will have a whole generation of programmers start to use it.

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You know, we showed the concept of what I consider to be the first personal computer to the financial community. The first announcement and demonstration was in New York in early '77. People said, "Why do people buy these things?" Kind of a funny question. I answered them with Edison's concept about the electrical industry: "What use is a baby?" Okay? And in fact, I think my implied prophecy was correct. Fundamentally, we're at that stage with voice. People will find a use for it.

PL What part of the design of this computer gave you the most satisfaction?

Peddle [Laughs] Making the company happen, for me personally, because I got a chance to do only a little bit of the design work this time. I did less on this computer than any of the things I've done over the past few years. I think the fact that we met all our goals, achieved all the things that we set out to do. This is the most sophisticated product that has been done in this kind of a marketplace. We had to bring together several talents who had not worked together before. Making all those talents come together—the guys that understood IBM-compatible communications along with the guy that designed the VIC-20. There's a lot of space between those people. Bringing them all together was satisfying. So I guess the answer to your question about the most satisfying part of the design of the computer was "none of the above."

PL What do you think general-purpose business microcomputers will be like two years from now?

Peddle Network. Lots of memory. Very, very hard-disk-oriented. Sold through a different channel from that which the current marketplace is mostly being sold through.

PL What sort of channel do you see?

Peddle I think that you're going to see more use of the mixture of direct and pseudodirect sales. I think you're



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going to see a lot of follow-on selling. More service-oriented kind of selling. I think you'll see computer retailers change into people who are more market-focused. I think you'll see a lot more vertical markets. Some of the people that others think of as more traditional retailers are going to focus more and more on selling this product in a packaged kind of way. I think you'll see dramatic changes in point-of-sale presentation. I think videodisc will be very important in both applications and point of sale.

PL What do you think home computers will be like two years from now? How many of them do you think will be around?

Peddle Luckily, millions. I think the market for computers split two years ago. I'm going to define two major segments, and there's a smaller middle segment. One major market segment is the throwaway computer, the concept that the Sinclair [ZX81] epitomizes—the kind of computer that nobody should buy but everybody does. Truly disposable. You get the VIC-20, the TRS-80 Color Computer kind of thing, which has meaning and usefulness in terms of computer literacy, games, some form of that kind of activity. And then you get the more serious, third-generation computers that are really aimed at solving problems. They're big, they've got enough disk capacity, and hooked together they really attack. I think what's happened is the guys who started this market find themselves in the middle. They're not powerful enough to compete with the higher-end guys, and they're too expensive to compete with the low-end guys. Other than the education market, which I consider to be a very specialized market and which I expect Atari to dominate—in this country at least, because they've got some real strong leads in that area—I think you're going to see a real dropping out of what I call the middle-range computer buyers. You're going to see a lot of stuff under five hundred dollars, and a lot of stuff in the three-to five-thousand-dollar price range,

and relatively little in between.

PL Looking at the other end of the microcomputer market, how much do you expect the superchips, like the Intel 80286 and the National Semiconductor 16032, to cut into the mini-computer market?

Peddle I'm going to not answer the question but give you an answer as to what I think is happening to the mini-computer market. I've been a distributed-intelligence fan and dedicated to making that marketplace happen since 1967, working for General Electric and for several companies that were really all distributed. I think I made a contribution to that marketplace. I think the minicomputer represented, at the beginning, a first step in distributed processing. I think the microcomputer companies are, in fact, representing the next step in that. And I think networked microcomputers are, in fact, a new product. Now, the question is, what benefit do I get out of a 32-bit machine? If I get a bigger language, better memory management, those kinds of things, code that I need to move from some other place, sure, I'll have that. But in fact, if you look at the number of new programmers and the number of people who have the opportunity to really crank out user-friendly and very meaningful programs, I think that's the most exciting thing about the microcomputer marketplace. It's not a given that the kind of programming that has to be done to make computers usable by people has to have that 32-bit power. Price drives people. Software availability drives people. But I think that the mainframe step-up in function is less important than what we do with databases, for instance. Does one of those micros make the generation of very powerful back-end database processing possible? Then it's very exciting.

PL So you think multi-user systems are going to fade away in favor of networking?

Peddle I've believed that for a long time.

PL Will multitasking, then, be an essential feature in single-user systems?

Peddle I think so. Just to run the networks and to do local spooling and all of the things that you want a computer to do. A computer should do what you want it to do. If it's capable of doing several things at one time and not slowing me up, it ought to do those things.

PL Without regard to the limits of current technology, what features would your own dream-machine have?

Peddle Voice in. Video messaging. A total product that allows me to work anywhere in the world and communicate with others anywhere in the world and with databases anywhere in the world.

PL Portable?

Peddle Both. One in my office and one in my briefcase and maybe one in every hotel room. I really want to be able to talk to them. I want to have all kinds of my own private storage. I want to have access to a worldwide network of storage.

PL What competitors do you fear more, the small start-up companies with venture capital or the big computer companies? Is the time past for the small company?

Peddle I felt that we were the last venture-capital start-up company—we're not venture capital, because we're funded by Kidde, but that was alternate venture capital. Fortune seems to be trying to prove me wrong. Grid does also. Grid has a specialized product. If we're not the last, Fortune is, in my opinion. The minicomputer company that I fear the most is DEC. The big computer company I fear the most is IBM. The third company I fear the most is whichever Japan decides to let be the winner.

PL You think they'll decide that?

Peddle I think if they don't, they won't beat either of the other two guys. ■

while avoiding a similar fate. For the Apple II and II Plus; floppy disk, \$29.95. Synergistic Software (see address above).

Atari

Cactus League Baseball, a two-player baseball game where one player controls the pitching, hitting, and fielding of the New York Yankees and the other player controls the Milwaukee Brewers. For the Atari 400 and 800; floppy disk, \$19.95. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Cyborg, an arcade-type game. To survive the gaming grids, you must battle and destroy the finest fighting machines ever developed. Half human and half machine, your cyborgs must fight a wide variety of killer robots. For the Atari 400 and 800; floppy disk and cassette, \$29.95. Med Systems Software, POB 3558, Chapel Hill, NC 27514.

Nautilus, an arcade-type game. This one- or two-player game pits a nuclear submarine against an antisubmarine destroyer. A split screen allows both players to simultaneously play the game. For the Atari 400 and 800; cassette, \$29.95. Synapse Software, 820 Coventry Rd., Kensington, CA 94707.

Rollerball, a futuristic combat game for two players. Strategy and brute force are the main tactics. For the Atari 400 and 800; floppy disk and cassette, \$21.95 and \$17.95, respectively. Dynacomp Inc. (see address above).

Teacher's Aid, a math drill program. It has subtraction, division, addition, and multiplication exercises and five levels of difficulty. For the Atari 400 and 800; floppy disk and cassette, \$17.95 and \$13.95, respectively. Dynacomp Inc. (see address above).

CP/M

Citation, a database-management program designed to allow quick access to constantly used information. Data fields may be up to 680 characters long with up to five keywords per entry. For CP/M-based systems; 5¼- and 8-inch floppy-disk formats, \$250. Eagle Enterprises, 2375 Bush St., San Francisco, CA 94115.

CPUTIL System, a set of programs that allows users with large disk-storage needs to more efficiently manage their files. For CP/M-based systems; floppy disk, \$49.95. Earth Science Associates, 10218 Cantertrot, Humble, TX 77338.

Directory-Sort Utility Version 3.7, a directory utility program for CP/M. It allows you to modify a directory for display in any format you choose and displays information on the disk memory available and organization of files. For CP/M; floppy disk, \$31.95 (Aus., plus \$10 postage). Software Source Ltd., POB 364, Edgecliff, New South Wales 2027, Australia.

FMS-80, a general-purpose data-management system composed of an integrated set of programs that can be configured for a custom database. For CP/M-based systems; floppy disk, \$995. Systems Plus Inc., 1120 San Antonio Rd., Palo Alto, CA 94303.

Help.Com, a computer-aided instruction program useful for storing and retrieving information about CP/M applications programs. You can create your own on-line instructions for your particular application. For CP/M-based systems; floppy disk, \$95. Designs Systems Inc., POB 12243, St. Louis, MO 63157.

The Introl-C Compiler, a compiler for the C language that produces fast object-code programming. For CP/M-

based systems; floppy disk, \$425. Introl Corp., 647 West Virginia St., Milwaukee, WI 53204.

Palantir Word Processing, a sophisticated word-processing system. This second-generation software performs all standard word-processing functions, including footers, headers, underlining, bold-face, and overstrikes. For CP/M-based systems; floppy disk, \$425. Designer Software, Suite 718, 3400 Montrose Blvd., Houston, TX 77006.

QSort, a coupon-management program. This program will store and sort information on up to 1600 store coupons. It can prepare a list of appropriate coupons compatible with your shopping list. For CP/M-based systems; floppy disk, \$39.95. BV Engineering, POB 3351, Riverside, CA 92519.

Stiff Upper LISP, an implementation of the LISP Programming language. Designed for compactness, this version retains many of the features that allow experimentation in artificial intelligence. For CP/M; floppy disk, \$165. Lifeboat Associates, 1651 Third Ave., New York, NY 10028.

The Wedge, an electronic spreadsheet program. This package includes installation, operation, and applications manuals. For CP/M-based systems; floppy disk, \$295. Systems Plus Inc. (see address above).

IBM Personal Computer

Math Drills, an educational math-drill package. Requires an 80-column monitor. For the IBM Personal Computer; floppy disk, \$25. Starware, Suite 800, 1701 K St. NW, Washington, DC 20006.

Quikcalc Real Estate Investor, a real-estate/financial-analysis package. This pack-

age includes a template for use with Visicalc or Supercalc. For the IBM Personal Computer; floppy disk, \$129.95. Simple Soft Inc., Suite 101, 480 Eagle Dr., Elk Grove, IL 60007.

Stocks and Bonds, a stock-market simulation game. Up to six players can compete to see who can accumulate the greatest wealth in the 10 simulated years of play. For the IBM Personal Computer; floppy disk, \$25. Avalon-Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

The Thinker, an electronic spreadsheet program. For the IBM Personal Computer; floppy disk, \$49. Texassoft, 1028 North Madison Ave., Dallas, TX 75208.

Trilogy, three games of the middle earth. Loosely based on the Tolkien novels, these games present you with challenges in your quest to become a wizard. For the IBM Personal Computer; floppy disk, \$35. Texassoft (see address above).

SYM-1

Medifile, a family-accounting program for medical and dental expenses. For the SYM-1; cassette, \$30. Lewis Davis, POB 1207, Chico, CA 95927.

Monifile, a financial-records program for family-budget control. For the SYM-1; cassette, \$45. Lewis Davis (see above address).

Texas Instruments

Aeronaut, a simulation of hot-air ballooning. The balloon responds to your control according to the laws of physics. For the TI-99/4A; cassette, \$21.95. Simulsoft, POB 3494, Scottsdale, AZ 85257.

The Dungeon, an adventure-type game where you try to find your way out of a maze with as much gold as possible. For the TI-99/4A; cassette, \$6. Frank Elssesser,

What's New?

tools, the book also covers image synthesis, analysis, and encoding. Detailed listings of many algorithms are provided.

Algorithms for Graphics and Image Processing costs \$24.95. Contact the Computer Science Press Inc., 11 Taft Court, Rockville, MD 20850, (301) 251-9050.

Circle 630 on inquiry card.

Logo Book Doubles As Self-Study Guide

A text and a self-study guide suited for use with the Logo programming language, *Turtle Geometry: The Computer as a Medium for Exploring Mathematics* has been released by the MIT Press. The authors, Harold Abelson and Andrea diSessa, are members of the Logo Group at the Massachusetts Institute of Technology's Artificial Intelligence Laboratory, where Logo was developed. Some of the topics explored are random motion, branching processes, space-filling designs, vector operations in two and three dimensions, topology of curves, maze-solving algorithms, and spherical and "cubical" geometry. Three hundred illustrations enhance this 477-page book, which costs \$22.50 and is available from the MIT Press, 28 Carleton St., Cambridge, MA 02142, (617) 253-2884.

Circle 631 on inquiry card.

Bulletin Describes Sonic Digitizer

Science Accessories Corporation is offering a free 2-page technical bulletin describing the capabilities of its Grafbar Model GP-7 sonic digitizer. The bulletin contains technical specifications, descriptions of the GP-7's menu features and output formats, and discusses available stylus, cursors, and sensors. The GP-7 permits left- or right-hand digitizing on any work surface.

For your copy, request technical bulletin GP-7-3-82 from Science Accessories Corp., 970 Kings Highway W., Southport, CT 06490.

Circle 632 on inquiry card.

VIC-20 User Guide

The VIC-20 User Guide, by John Heilborn with Ran Talbott, addresses experienced and beginning programmers alike. Produced by Osborne/McGraw-Hill, this 250-page paperback book provides operating instructions for the Commodore VIC and its associated peripherals, such as disk drives, printers, and modems. It has tutorials in VIC-20 BASIC and detailed coverage of BASIC statements and functions, including advanced color graphics. Appendices offer further information on trigonometric functions and assembly codes and machine-level subroutines. Also provided is a memory map specifying many PEEK and POKE locations.

The VIC-20 User Guide costs \$16.95. Contact Osborne/McGraw-Hill, 630 Bancroft Way, Berkeley, CA 94710, (415) 548-2805.

Circle 633 on inquiry card.

MISCELLANEOUS



Fujitsu to Market Plasma Display

The Component Division of Fujitsu America is marketing a 480-character plasma-display panel called the FPC 4012 NRUL. It uses monolithic integrated circuits for its drive circuits and CMOS (complementary metal-oxide semiconductor) LSI (large-scale integration) devices for control logic. The unit features high-contrast orange characters on a black background and a CRT- (cathode-ray tube) compatible interface that connects to various system buses through a CRT controller. Power consumption is 13 watts.

The FPC 4012 NRUL costs \$597 in OEM (original equipment manufacturer) quantities. Contact George Neeno, Fujitsu America Inc., Component Division, 918 Sherwood Dr., Lake Bluff, IL 60044, (312) 295-2610.

Circle 634 on inquiry card.

Fast Floating Point for Atari

The Fastchip floating-point mathematics ROM (read-only memory) from Newell Industries is said to provide up to three and one-half times the speed of the original Atari BASIC floating-point routines. Fastchip is pin-compatible with the ROM it replaces and requires no modifications, cuts, or wires.

Fastchip costs \$41.95, including shipping and handling. It comes with a 90-day warranty. Overseas orders are \$2 higher. For additional information, contact Newell Industries, 3340 Nottingham Lane, Plano, TX 75074, (214) 423-1781.

Circle 635 on inquiry card.

Stack Rack

The Stack Rack from Remtron lets you tuck more than 600 sheets of paper underneath your Epson MX-80 printer. Stack Rack features a ball guide that prevents the paper from snagging and a paper stop that halts the paper from sliding out the rear during operation or transportation. The unit is constructed of clear acrylic and is equipped with skid-resistant padded feet.

Stack Rack costs \$14.95, plus \$2 shipping and handling. Order from Remtron, POB 2280, Santa Clara, CA 95055.

Circle 636 on inquiry card.

The Coinless Arcade—Rediscovered

Pamela Clark, Technical Editor
and Gregg Williams, Senior Editor

A faceless stranger gave you directions the first time you came to The Coinless Arcade. After a glorious night of gaming, you came away retaining a pocket full of quarters and not a few new friends. Everyone met together the next night, ready for more gaming, but you could not find the arcade—anywhere! Night dampness chilled your bones as the search continued, and, for a while, you combed the town every night: still, no arcade. You kept in touch with your new friends, if only to prove that you hadn't imagined it all.

A year has passed. You walk out the alley exit of a theater and, surprised, hear faint arcade noises. You follow them through the alleyways, only distantly aware that you never cross a main street. And there it is: the neon facade declaring "The Coinless Arcade" with festive colors, the air alive with electronic sounds. Once inside, you see a familiar face,

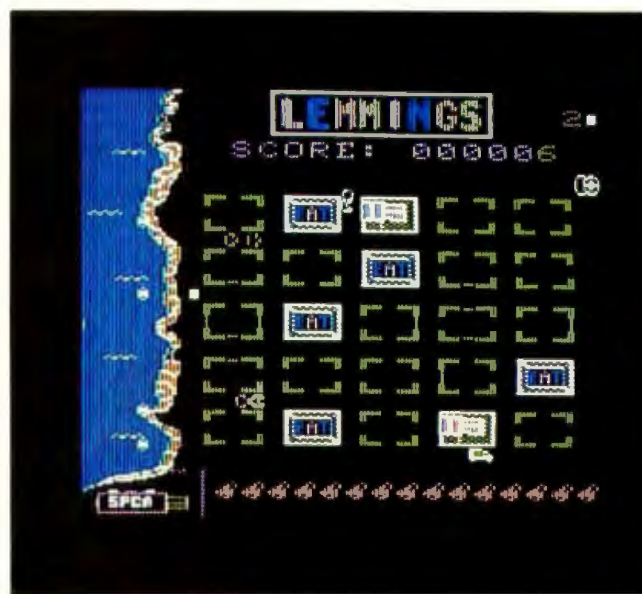
then another. Soon everyone has arrived. Laughing, you run to the nearest empty machine, reach for some quarters—and realize there's no need. You wish your friends good luck and press the flashing red button labeled START. The fun begins again.

Another computer gaming year has passed. Game designers continue to squeeze more than we've ever seen before from a given machine, and we applaud their efforts. In fact, some of the most exciting programming this year has been done for the cartridge game systems. That's why we're including two pages of games for the Atari (or Sears) Video Computer System and the Mattel Intellivision Game System.

Luckily for you players, The Coinless Arcade exists in your imagination and in your microcomputer. We've brought you these games from our Coinless Arcade. Put them in your microcomputer (or cartridge game system) and they're yours forever.



Playing Cannonball Blitz can provide entertainment for you and chuckling enjoyment for a crowd of onlookers. The object of the game is to get the rebel soldier up Nutcracker Hill and destroy the castle. The poor soldier, however, must contend with a barrage of cannonballs and constant trips and obstacles. It becomes hard not to laugh as you try to outrun or jump over cannonballs, or just plain get out of the way. **Cannonball Blitz** by Olaf Lubeck for the Apple II or II Plus, \$34.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.



Want a challenge with a bizarre twist? First, you take a job with the ASPCA and are put in charge of controlling the lemming population. All you have to do is lock them in a room so they won't breed. Sounds easy until you try it. There are lemmings running everywhere, breeding faster and faster and getting run over by trucks. If you're not real careful, a mass suicide occurs as they march to the sea. This is one of the strangest topics for an arcade game that we have seen. **Lemmings** by Jerry Jewell, Terry Bradley, and Dan Thompson for the Apple II or II Plus, \$29.95 (disk), from Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.



The city is under attack, and it's up to you to rescue the only remaining inhabitants. Pilot your Needlefighter and swoop in, picking up each of the 18 survivors and transport them through a hazard-filled sky to temporary safety. Once you have saved all of the people, you must risk your life and theirs once again, as you move them to permanent quarters. It isn't easy—hero stuff never is. **Protector** by Mike Potter for the Atari 400/800, \$34.95 (cassette), from Synapse Software, 820 Coventry Rd., Kensington, CA 94707. (Also available on disk.)



If you love playing two-person strategy games but can't always find a willing opponent, *Renaissance* may be the answer. This is a computer version of the board game Othello (trademark of Gabriel Industries) that is designed to let you challenge the machine, although it may be used with two human players. You can choose from eight levels, set up special games, and save and recall games from tape. **Renaissance** by Louis X. Savain for the VIC-20, \$49.95 (cartridge), from United Microware Industries Inc., 3503-C Temple Ave., Pomona, CA 91768.

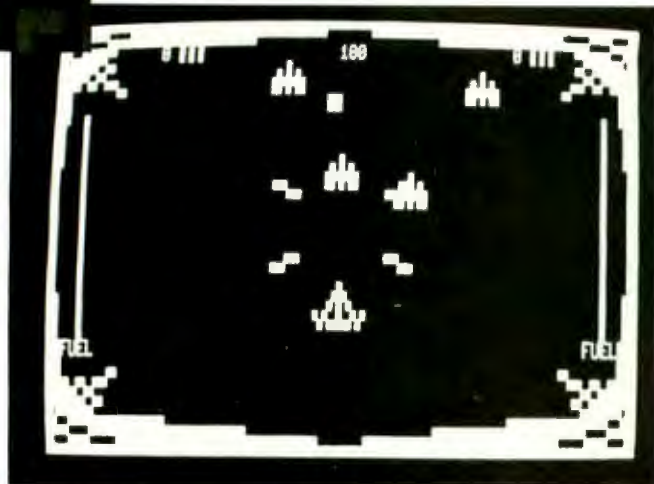


As the commander of a nuclear submarine, you guide your vessel through a subterranean obstacle course, avoiding mountains, twisting through passages, and staying away from the webs of explosive mines rising from the sea floor. And if that wasn't enough to make a hazardous trip, watch out for the enemy attack stations, falling stalactites and mines, and, of course, lasers. The scrolling seabottom gives you the equivalent of 24 screens laid end-to-end, and the game also offers a two-player option. **Sea Dragon** by Wayne Westmoreland and Terry Gilman for the TRS-80 Models I and III, \$24.95 (disk), from Adventure International, POB 3435, Longwood, FL 32750. (Also available for the Apple and the Atari 400/800.)



Amid the sounds of explosions and the sight of burning buildings, you must maneuver your helicopter and rescue the 64 kidnapped delegates to the United Nations Conference on Peace and Child Rearing. Watch out for jet fighters and air mines and try to get as many of the hysterical hostages back to safety as you can. It's great fun manipulating the helicopter with a joystick acting as the throttle; and the little folks on the ground really wave to you! **Choplifter!** by Dan Gorlin for the Apple II or II Plus, \$34.95 (disk), from Broderbund Software, 1938 Fourth St., San Rafael, CA 94901. (Requires joystick with two buttons; also available for the Atari 400/800.)

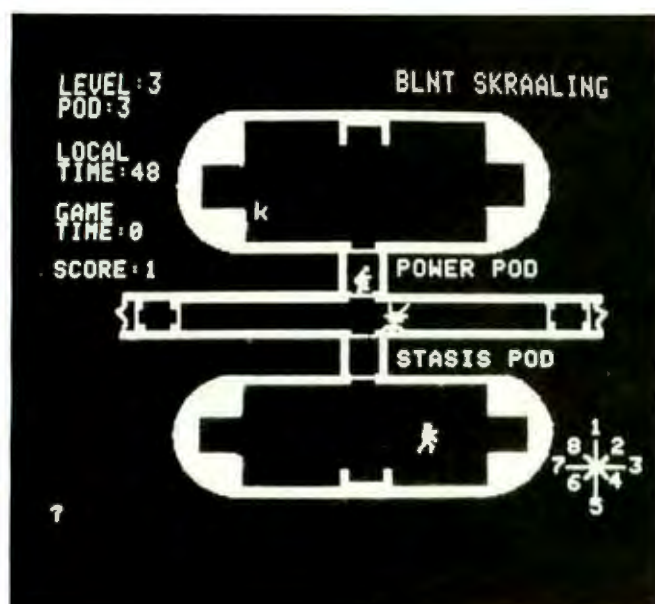
COINLESS ARCADE



Escorting and defending cruisers through front-line battle zones becomes a hazardous task when Cretonian forces try to destroy your protective field. Your fuel supply is limited, so your mission must be completed rapidly, while you fight off three waves of Cretonian ram craft, energy torpedoes, and Kilr mines. **Stellar Escort** by Jeff Zinn for the TRS-80 Models I and III, \$19.95 (disk), from Big Five Software, POB 9078-185, Van Nuys, CA 91409. (Also available on cassette.)



If you suffer from nightmares of being caught in a snake-filled maze, don't play **Serpentine** before bedtime. Not only must you try to keep your nice blue serpents alive, but you must also make their lives long enough to lay eggs and raise new serpents. You can't merely avoid predator serpents: you must eat them in order to grow. Big serpents always swallow little serpents, so growing up fast can be a real advantage. **Serpentine** by David Snider for the Apple II or II Plus, \$34.95 (disk), from Broderbund Software, 1938 Fourth St., San Rafael, CA 94901.



Use your problem-solving skills in a science-fiction scenario that makes you race against the clock in a simulation of an emergency situation aboard a biological survey spaceship. After a mid-space accident, your ship begins to malfunction. The crew must locate the main computer console, access the plans to the multipod vessel, and repair the damage before time runs out. During the search, you must look out for dangerous biological specimens and attacking robots. While the game can be played as solitaire, it can also incorporate up to seven players in a cooperative effort to save the ship (and your lives!). **Wreck of the B. S. M. Pandora** by Stephen Abrams for the Apple II or II Plus, \$50 (disk), from Apple Computer Inc., 20525 Mariani Dr., Cupertino, CA 95014.



If you always had a secret desire to conquer barbarian hordes, **Legionnaire** is the game for you. High-resolution graphics, sound, and real-time combat combine to create a live-action battlefield. You command the Roman Legions of Julius Caesar, while the computer controls the Gaulish barbarian hordes. With up to ten legions to command, you select any two of 16 barbarian tribes to fight. The game provides you with a topological map, which must be mastered to defeat the most vicious of the barbarians. Don't let the cover art deter you (the worst we've seen this year!)—the game is great entertainment, even for those who haven't been war-game fans before. **Legionnaire** by Chris Crawford for the Atari 400/800, \$35 (cassette), from Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214. (Also available on disk.)



The Guinness Book of World Records must be getting ready for a computer games category, if Time Zone is any indication of things to come. Without a doubt, it is the longest adventure to date with more than 1400 color graphic pictures and six floppy disks packed (front and back!) with this challenging game. Not only do you become a time traveler, but you must be able to solve puzzles built into the game. This ultimate adventure is already a legend in its own time. **Time Zone** by Ken and Roberta Williams for the Apple II or II Plus, \$99.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.



The award (if we had one) for the most arcade-like game of the year would go to Bandits. In this spectacular contest, every new wave of aliens has a different strategy and a different weapon to challenge you. And, of course, the more you manage to blast them off your screen, the faster they attack. Good graphics and great action make this game a must for arcade fans. **Bandits** by Tony and Benny Ngo for the Apple II or II Plus, \$34.95 (disk), from Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827. (Also available for the Atari.)



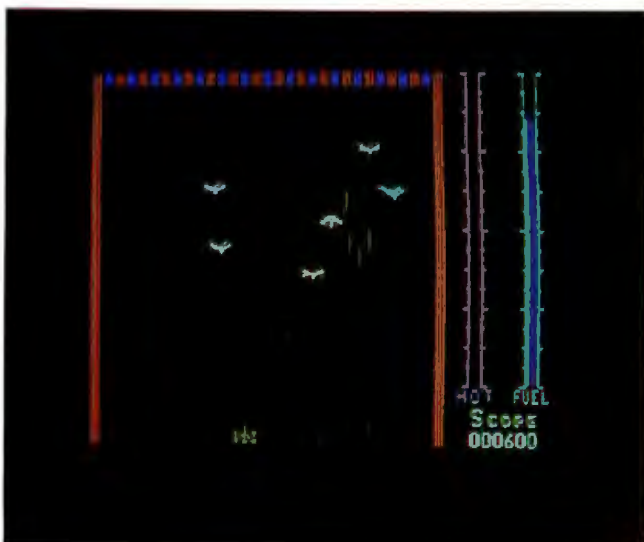
If you have always been a fan of the old Saturday matinee monster movies, here is a game that allows you to create your own interactive version. Choose your favorite locale to be devoured: Washington, Tokyo, New York, or San Francisco. Next, from a choice of six killer creatures, select the monster you would most like to be when you grow up. With more than 100 possible scenarios, you can wreak havoc to your heart's content. Watch out for the National Guard and the mad scientist, though, because they are determined to eliminate your monster at any cost. **Crush, Crumble, and Chomp!** by Jon Freeman, J. W. Connelley, Michael Farren, and Toni Thompson for the Apple II or II Plus, \$29.95 (disk), from Epyx/Automated Simulations Inc., 1043 Kiel Court, Sunnyvale, CA 94086. (Also available on disk for the TRS-80 Models I and III and the Atari 400/800 and on cassette for the VIC-20.)



For an added thrill, try using two joysticks with **Cyborg**. Move your human/machine hybrid with one joystick and fire with the other as you battle robots, killer hyper-spheres, and giant spiders in a series of arenas. Each arena or wave may contain all of one type of opponent or a mixture of all, with each new arena harder to get through than the one before. **Cyborg** by Simon Smith for the Atari 400/800, \$29.95 (disk), from Med Systems Software, POB 2674, Chapel Hill, NC 27514.



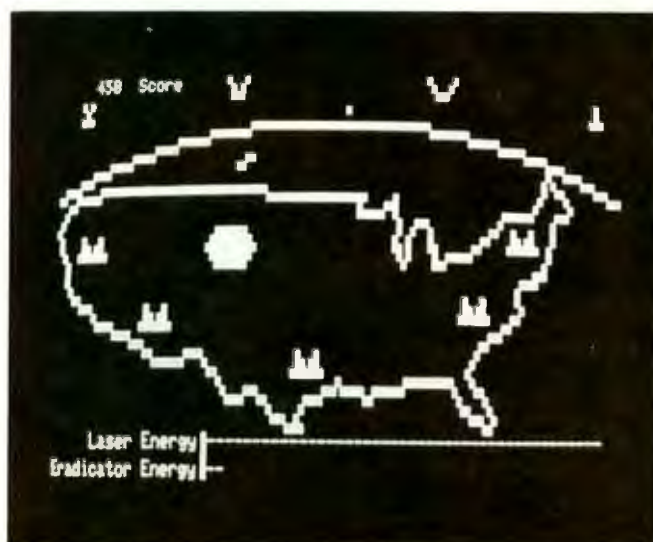
By allowing you to independently shoot and move in four directions, *Crossfire* emerges as one of the most difficult and challenging arcade games to play. Surrounded by aliens, with laser shots flying at you from all directions, you are confined in a grid. Instead of the freedom of the skies, you must exercise tight control over the movement of your ship, firing missiles at the same time. The reflexes take a long time to master, but, once you get the hang of it, it's addictive. *Crossfire* by Jay Sullivan for the Apple II or II Plus, \$29.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614. (Also available on disk, cassette, or cartridge for the Atari 400/800.)



Endless waves of aliens (what else?) fill the skies. They are programmed to destroy you. You shoot at them, but if you shoot too quickly, your guns overheat and it's doomsday once again. The graphics are stunning, with each wave bringing a new variety of alien invader. *Threshold* by Warren Schwader and Ken Williams for the Apple II or II Plus, \$39.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614. (Also available for the Atari 400/800.)



As Dakota Smith, adventurer, treasure hunter, you must locate the golden Mask of the Sun to halt the deterioration of your body brought on by a mysterious amulet. You begin your quest for this solid gold mask with a face-to-face meeting with Professor de Perez in the Aztec ruins of Mexico. This graphics adventure uses a special animation and graphics language to draw full-screen graphics quickly enough to give the illusion of movement: people walk toward you and your jeep cruises down a country road. *The Mask of the Sun* by Alan Clark, Larry Franks, and Christopher and Margaret Anson for the Apple II or II Plus, \$39.95 (disk), from Ultrasoft Inc., 24001 Southeast 103rd St., Issaquah, WA 98027.



You're in control of the strategic defense satellites of the United States and, looking through your viewfinder, you can see nuclear rockets being launched from the Soviet Union. Quickly, you must intercept the rockets and destroy all of the Soviet missile sites as well. But the missiles keep coming, and now even your satellites are under attack. A graphic arcade experience awaits. *Laser Defense* by Simon Smith for the TRS-80 Models I and III, \$18.95 (disk), from Med Systems Software, POB 2674, Chapel Hill, NC 27514.



SPECIAL EFFECTS

As the game loads, a voice announces the title, *Space Spartans*. This is the first cartridge designed for use with the Intellivoice Voice Synthesis Module. Four voices are generated, but only two are used with regularity: the ship's computer and your central computer. The game is designed to be a reenactment of the Battle of Thermopylae in space. Because the voices provide vital information, the game isn't playable without the synthesis module. *Space Spartans* for Intellivision, \$45 (cartridge; Voice Module, \$80), from Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

Phasor Patrol is included when you purchase a Supercharger for your Atari VCS. (The Supercharger plugs into the cartridge slot on your machine and adds enough memory to give games increased action and more graphic detail. The games, available on cassette, load rapidly from any cassette player.) *Phasor Patrol* lets you use a sector map to warp hop from one section of the galaxy to another. The hyperdrive simulation is very impressive. Using the second screen, you locate enemy forces and use the torpedo sight to lock-in on your target. Scoring well in this game is a combination of skill and strategy. *Phasor Patrol* for the Atari VCS (video computer system), \$69.95 (cassette; includes the Supercharger), from Starpath Corp., 324 Martin Ave., Santa Clara, CA 95050.



OLD FAVORITES

A graphics version of an old computer game, *Utopia* lets you rule your own island state. One or two players can compete by scoring points that reflect the overall well-being of the people you rule. By controlling agriculture, housing, education, the military, industry, and hospitals, you alone are responsible for the people. Just remember to keep an eye out for the rebels and pirate ships. *Utopia* for Intellivision, \$40 (cartridge), from Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

Although not a new entry, *Tennis* is a favorite here at BYTE. Not only is this game engaging, the winning feature is that the ball carries a shadow underneath it. Try it when you can't get outdoors for your exercise at the net. *Tennis* by Alan Miller for the Atari VCS, \$22.95 (cartridge), from Activision, Drawer 7286, Mountain View, CA 94042.



RE-CREATIONS

An implementation of one of the most successful arcade games, **Defender** is now available for you to play at home. You are the commander of a spaceship trying to blast the aliens from the skies and rescue the kidnapped humanoids before they are transformed into flying mutants. An excellent adaptation of the original. **Defender** for the Atari VCS, \$37.95 (cartridge), from Atari Inc., POB 427, Sunnyvale, CA 94086.

Another favorite of the commercial arcades is ready to challenge you at home. In **Berzerk**, you are trapped in an electronic maze, hounded by robots and the Evil Otto. Use the joystick to move through the maze and hit the button to fire your laser at the robots. Several playing options let you choose between armed and unarmed robots, characteristics for Otto, and the number of bonus lives available. **Berzerk** for the Atari VCS, \$31.95 (cartridge), from Atari Inc., POB 427, Sunnyvale, CA 94086.

One of the favorites for all ages, **Frogger** is a faithful implementation of the coin-operated video game with an extra bonus: an easy option that lets the frog stay on the moving log when it wraps around to the other side of the screen. Trying to get the poor frog to hop across the busy highway can be quite a trick. **Frogger** by Ed English for the Atari VCS, \$30 (cartridge), from Parker Brothers, POB 1012, Beverly, MA 01915.



NEW!

Pitfall Harry has three chances and 20 minutes to find gold and silver bars, money bags, and diamond rings. But on his way to discover all of these treasures, he must avoid crocodile-infested swamps, vicious cobras, disappearing tar pits, and deadly scorpions in the underground passage. One of the trickiest moves you have to learn is how to make Harry jump up and catch the swinging vine. **Pitfall** by David Crane for the Atari VCS, \$31.95 (cartridge), from Activision, Drawer 7286, Mountain View, CA 94042.

The Imperial Walkers are on the march, and you must use your fleet of Snowspeeders to destroy them before they reach the power generator on the ice planet Hoth. Using a joystick to maneuver your craft, you fly over, around, and under the lumbering army of Walkers. Your battlefield is eight television-screens-wide, and the enemy will approach you in single file from left to right. When the lead Walker reaches the right end of your radar band, the power generator is a lost cause. A surprisingly strong entry for a first attempt in the video-game market. **The Empire Strikes Back** by Rex Bradford for the Atari VCS, \$30 (cartridge), from Parker Brothers, POB 1012, Beverly, MA 01915.

Design Techniques and Ideals for Computer Games

Chris Crawford
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POB 427
Sunnyvale, CA 94086

Why are some computer games better than others? Game manufacturers and authors constantly try to answer this million-dollar question. Many factors contribute to the appeal of a computer game, including technical quality, graphics, sound, pace, game play, and action. Yet we cannot merely list the properties of a given game and expect the length of the list to tell us whether that game will be a success. Game design is an art form, and like any art form the individual components are less important than the manner in which they are put together, the overall technique.

All artists develop their own special techniques and ideals for the execution of their art. The painter worries about brushstrokes, mixing of paint, and texture; the musical composer learns procedures of orchestration, timing, and counterpoint. The game designer also acquires a variety of specialized skills, techniques, and ideals for the execution of the craft. In this article I will describe some of the techniques I use in my games. I don't understand my own art well enough to present my techniques in a hierar-

chical or logical sequence; instead, I'll simply offer a potpourri of interesting ideas grouped under the concepts of balance, relationships, monotonicity (having a positive monotonic learning curve), and winnability.

Balancing Solitaire Games

A solitaire game pits the human player against the computer. The computer and the human are very different creatures; where human thought processes are diffuse, associative, and integrated, the machine's thought processes are direct, linear, and arithmetic. This difference causes a problem. A designer creates a computer game for the benefit of the human, and therefore the game is played in the intellectual territory of the human, rather than in the intellectual territory of the computer. The computer is thus at a natural disadvantage. Although the computer could easily whip the human in games involving computation, sorting, or similar functions, such games would be of little interest to the human player in most cases. The computer must play on the human's home turf, which it does with great difficulty. How, then, do we design a game to enable the computer to compete with and challenge the human? Four techniques are available: *vast resources*, *artificial reckoning*, *limited information*, and *pace*.

Vast Resources

In what is by far the most heavily used technique for balancing a game, the designer provides the computer with immense resources that it uses stupidly. These resources may consist of large numbers of opponents that operate with only the most rudimentary intelligence. Many games use this ploy: Space Invaders, Missile Command, Asteroids, Centipede, and Tempest, for example. It is also possible to equip the computer with a small number of opponents more powerful than the human player's units, such as the super-tanks in Battlezone. The effect in both cases is the same: the human player's advantage in intelligence is offset by the computer's material advantages.

The vast-resources technique has a number of benefits. First, the conflict between the human and the computer assumes a David-versus-Goliath air. Most people would rather win as an apparent underdog than as an equal. Second, this technique is the easiest to implement. Providing intelligence for the computer's players can be difficult, but making hordes of computer players repeat a single process takes little more than a simple loop. Of course, the ease of implementation carries a disadvantage: everybody can do it. We are knee-deep in such games. Laziness and lack of determination have far more to do with

About the Author

Chris Crawford leads the Games Research Group at Atari. He has designed several microcomputer games and has written articles and books about computers and programming.

the prevalence of this technique than game-design considerations.

Artificial Reckoning

The obvious alternative to giving the computer player an advantage of sheer numbers is to provide it with intelligence adequate to meet the human player on equal terms. Unfortunately, artificial intelligence techniques are not understood well enough to be useful in this context. The development of tree-searching techniques allows us to produce passable chess, checkers, and Othello computer players. Any other game that can be expressed in direct tree-searching terms can also be handled with these techniques. Very few games, however, are appropriate for this treatment.

An alternative is to develop ad hoc artificial intelligence routines for each game—the method I have used in *Tanktics*, *Legionnaire*, and *Eastern Front 1941* with varying degrees of success. Although this strategy demands great effort from the game designer, the routines are so primitive that referring to them as artificial intelligence is misleading and almost arrogant. Instead, I use the less ambitious term artificial reckoning.

The first aim of any artificial reckoning system is to produce reasonable behavior. The computer should not drive its tanks over cliffs, crash spaceships into each other, or pause to rest directly in front of the human's guns. In other words, the artificial reckoning system must not allow obviously stupid moves. This requirement tempts us to list all possible stupid moves and write code that tests for each such stupid move and precludes it. This is the wrong way to handle the problem because the computer can demonstrate unanticipated creativity in the stupidity of its mistakes. A better (but more difficult) method is to create a more general algorithm that obviates the most absurd moves.

A second requirement of an artificial reckoning routine is unpredictability. The human player should never be able to second-guess the

behavior of the computer, for this would shatter the illusion of intelligence and make victory much easier. This second condition seems to contradict my first requirement of reasonable behavior because reasonable behavior follows patterns that should be predictable. We can resolve this apparent contradiction through a deeper understanding of the nature of interaction in a game. To arrive at such an understanding, we must combine three premises. First, a reaction to an opponent is in some ways a reflection of that opponent. A reasonable player tries to anticipate an opponent's moves by assessing the opponent's personality. Second, interac-

tiveness is a mutual reaction—both players attempt to anticipate each other's moves. Third, the level of interactiveness is a measure of the quality of the game. We can combine these three premises in an analogy. Think of a game in terms of two mirrors facing each other, with each player looking out from one mirror. A weakly interactive game is analogous to two mirrors *almost* aligned toward each other; each player can see and interact at one or two levels of reflection. An ideal, perfectly interactive game is analogous to two highly reflective mirrors aligned *precisely* toward each other; each of the two players recursively exchanges

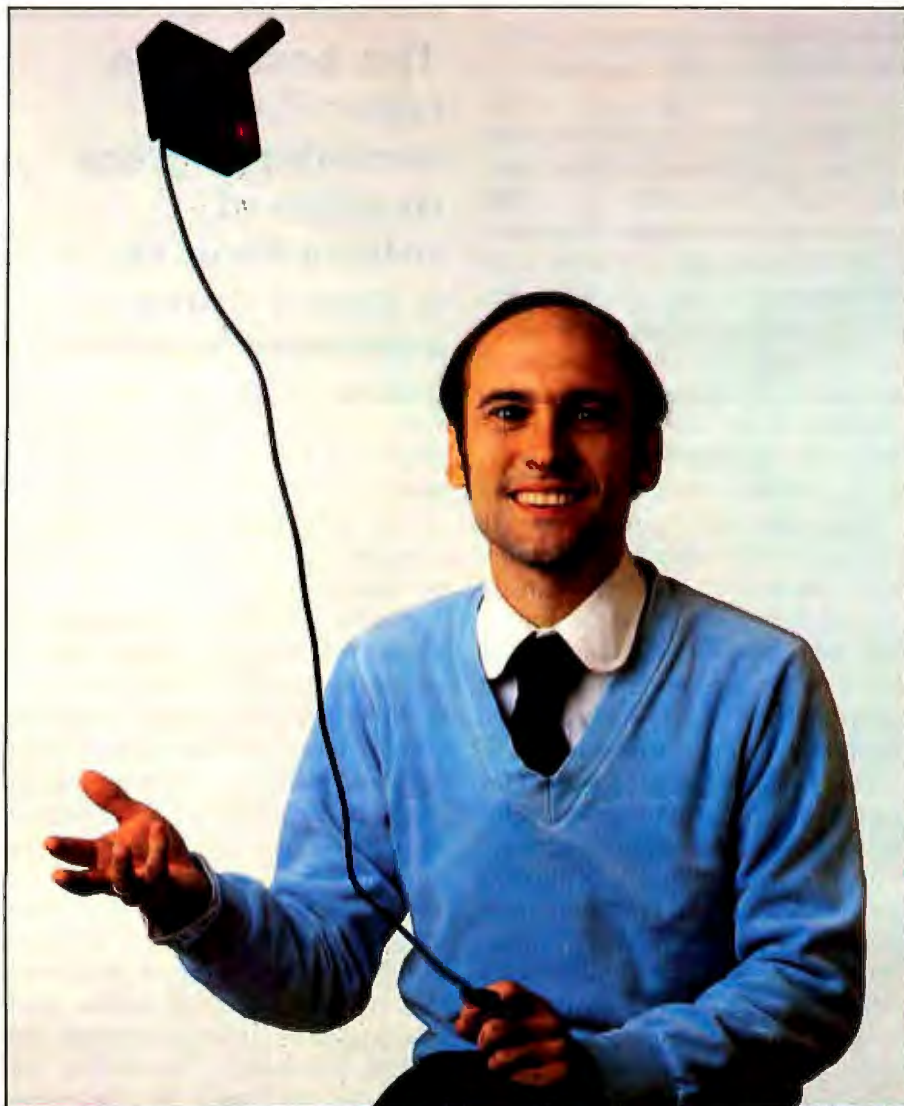


Photo 1: Chris Crawford, computer-game artist, uses a variety of design techniques to create new, stimulating games for the microcomputer. Photo by Franklin L. Avery.

places in an endless tunnel of reflected anticipations. No matter how reasonable the behavior, the infinitely complex pattern of anticipation and counter-anticipation defies prediction. The pattern is reasonable yet unpredictable, and thus satisfies the requirements of artificial reckoning.

Experience has shown me that game algorithms are most predictable when they are particular, emphasizing a single element of the overall game gestalt. For example, in war games, algorithms such as "determine the closest enemy unit and fire at it" are particular and yield predictable behavior.

I find that the best algorithms for reasonable and unpredictable behavior consider a greater amount of information in a broader context. That is, they will factor into their decision making a large number of considerations rather than focus on a small number of key elements. Compared to the example above, a better algorithm might be "determine the enemy unit posing the greatest combination of threat and vulnerability (based on range, activity, facing, range to other computer tanks, cover, and sighting); fire on unit if probability of killing exceeds probability of being killed."

How does one implement such principles into specific, programmable algorithms? I doubt that an all-purpose system can ever be found. The best general solution I have found so far uses a combination of point systems, field analysis, and changes in the game structure.

First, I establish a point system for quantifying the merit of each possible move. This is a time-honored technique for many artificial intelligence systems. A great deal of thought must go into the point system. An initial complication is one of dynamic range: the designer must ensure that the probability that two accessible moves will each accumulate a point value equal to the maximum value allowed by the word size (8 bits) approaches zero. In other words, we

can't have two moves each getting a score of 255 points or we have no way of knowing which is truly the better move.

Another problem with the point system is the balancing of factors against each other. Suppose we have a tank game in which we know that climbing on top of a hill is good, but we also know that moving onto a road is good. Which is better? If a hilltop position is worth fifteen points, what should a road position be worth? Ten points? Twenty? You really need a deep familiarity with the play of the game to answer these questions. Unfortunately, such

The best game algorithms consider a great amount of information in a broad context.

familiarity is impossible to attain with a game not yet completed. Instead you have to rely on broad experience, a thorough understanding of the situation being represented, painstaking analysis, and lots of experimenting.

Another artificial reckoning technique, field analysis, applies only to games involving spatial relationships. In such games the human relies on pattern recognition to analyze positions and plan moves. The microcomputer is incapable of true pattern recognition on the same level as humans; however, field analysis allows the computer to attain something approaching pattern recognition. The key effort for the designer is the creation of a calculable field quantity that correctly expresses the critical information needed by the computer to make a reasonable move. For example, in several of my war games I've used safety and

danger fields to tell a unit the level of risk in a given situation. Danger is calculated by dividing each enemy unit's strength by its range and summing the quotients of the different units; thus large or close units are very dangerous, and small or distant units are only slightly dangerous. A similar calculation with friendly units yields a safety factor. A unit decides whether to exhibit bold or timid behavior by comparing the danger and safety values at its position. Once this decision is made, the unit looks around and measures the net danger minus safety in each position it could move to. If the unit is feeling bold, it moves toward the danger; if it is feeling timid, it moves away. In this particular case, I find a vector field to be more informative than a scalar field; in some cases the scalar field is adequate. The vector field tells the magnitude and direction of danger; the scalar field tells only the magnitude. If the algorithm is intelligent enough to use the direction information, the vector field is more useful.

Coordinating the moves of the many units under computer control is a special dilemma. How is the computer to assure that the different units move in a coordinated way and that traffic jams don't develop? Usually the game designer's response is to use a sequential planning system coupled with a simple test to determine the position of other units. Thus, unit #1 moves first, then #2, followed by #3, with each one avoiding collisions. I can assure you from my own experience that this system serves only to replace collisions with the most frustrating traffic jams. A better method uses a virtual-move system in which each unit plans a virtual (hypothetical) move based on the virtual positions of all other units. Here's how it works: we begin with an array of real positions of all computer units. We create an array of virtual positions and initialize all virtual values to the real values. Then each unit plans its move, avoiding colli-

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Photo 2: *Legionnaire*, a recently released war game about Caesar and the barbarian hordes, is a good example of a refined attack algorithm. Chris tried several strategies before the single advance-to-attack algorithm emerged.

sions with the virtual positions. After the unit plans its move, the planned final position is put into the virtual array. Other units then plan their moves. After all units plan one virtual move, the process repeats, with each unit planning its move on the basis of the interim virtual-move array. This huge outer loop should be convergent; after a sufficient number of iterations the routine terminates and the virtual positions form the basis of the moves made by the computer's units. This technique is useful for coordinating the moves of many units and preventing traffic jams.

Another technique for achieving reasonable and unpredictable algorithms is so simple that it seems like cheating: change the game. If a crucial element of the game is not tractable with artificial reckoning, remove it. If you can't find a good way to use a feature, you really have no choice but to delete it. For example, while designing *Tanktics*, I encountered a problem with certain

lakes. If the computer approached a U-shaped lake from the wrong direction, it would drive its tanks to the end of the peninsula formed by the lake, see the water blocking its forward progress, back up, change direction slightly, and drive back into the peninsula, only to be blocked again by the lake. The U-shaped lake created a trap for my artificial reckoning algorithm. I expended a great deal of time working on a smarter artificial reckoning routine that would not be trapped by such lakes and yet would retain desirable economies of motion. After much wasted effort I discovered a better solution: delete U-shaped lakes from the map. Ideally, the experienced game designer has enough intuitive feel for algorithms to sense game factors that are intractable and avoid them during the design stages of the game. However, most of us must discover these things the hard way and retrace our steps to modify the design.

No matter how good an algorithm

is, its applicability is limited. The odds are that a specific algorithm will work best under a narrow range of conditions. To be truly interesting, a good game design must offer a broad range of conditions. Thus with many games the designer must create a number of algorithms and switch from one to another as conditions change. The transition from one algorithm to another is fraught with peril; if you don't maintain continuity across the transition, the computer units may exhibit highly unreasonable behavior patterns. I well remember a frustrating algorithm transition in *Legionnaire*. The computer barbarians were controlled by three algorithms that caused them to either run for safety, approach to contact, or attack. Under certain conditions a barbarian operating under the approach-to-contact algorithm would decide on bold behavior, dash forward to make contact with the human, and make the transition to the attack algorithm, which would declare an attack unsafe. The barbarian would thus balk at the attack and convert to the run-for-safety algorithm, which would direct it to turn tail and run. The human player was treated to a spectacle of ferociously charging and frantically retreating barbarians, none of whom ever bothered to actually fight. I eventually gave up and redesigned the algorithms, merging all three into a single advance-to-attack algorithm with no transitions.

The artificial reckoning techniques I have described so far are designed for use in games involving spatial relationships. Many games are non-spatial and require other reckoning techniques. A common type of non-spatial game is a complex system simulation, often involving coupled differential equations. *Lunar Lander*, *Hammurabi*, *Energy Czar*, and *Scram* are examples of this type of game. In such games the primary problem facing the designer is not so much to defeat the human as to accurately model system behavior. I advise the game designer to be particularly

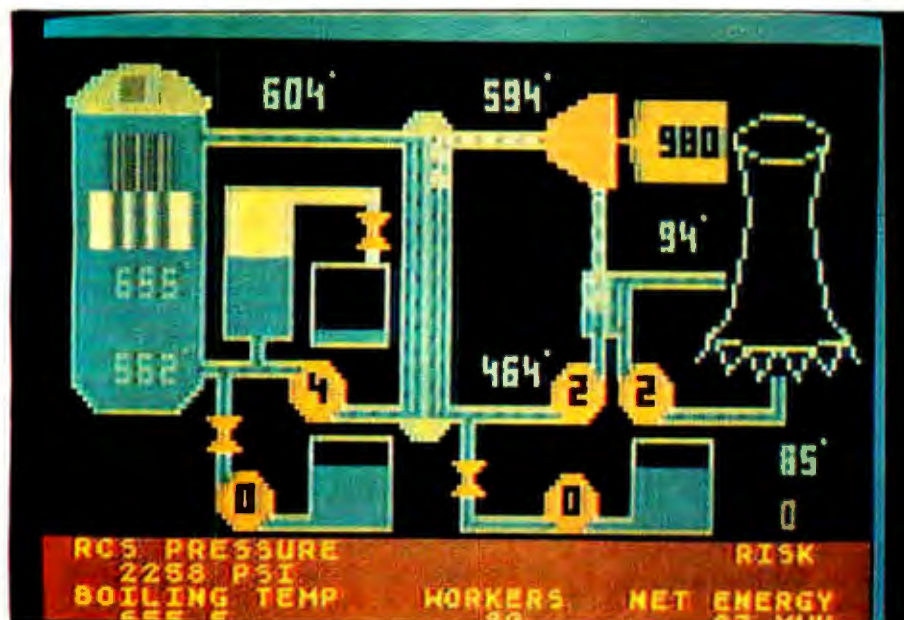


Photo 3: *Scram* is a nuclear-power-plant simulation that uses coupled differential equations to model complex behavior.

Photo by Franklin L. Avery.

careful with games involving large systems of coupled differential equations. *Hammurabi* uses three coupled first-order differential equations, and most programmers find that number easy to manage. But the complexity of the problem rises very steeply with the number of differential equations used. *Energy Czar* used the fantastic sum of 48 differential equations, a feat made believable only by the fact that many constraints were imposed on them. In general, be wary of more than four coupled differential equations. If you must use numerous differential equations, try to use parallel equations in which the same fundamental equation is applied to each element of an array of values.

Each differential equation should have a damping factor that must be empirically adjusted:

$$\text{new value} = \text{old value} + \frac{\text{driving factor}}{\text{damping factor}}$$

A small damping factor produces lively simulated systems that bounce around wildly. A large damping factor yields sluggish systems that change slowly. Unfortunately, recourse to simple damping factors can backfire when a relationship of

negative feedback exists between the new value and the driving force. In this case, a large damping factor inhibits the negative feedback, and one of the variables changes erratically. The behavior of systems of differential equations is complex; I suggest that designers interested in these problems familiarize themselves with the mathematics of overdamped, underdamped, and critically damped oscillatory systems. For more general information on solving systems of differential equations, any good textbook on numerical analysis will serve as a useful guide.

The application of all these methods may well produce a game with some intelligence, but your expectations should not be too high. Even great effort is not enough to produce truly intelligent play. To date, none of my three attempts play with adequate intelligence to tackle a human player on equal terms. Indeed, they still need force ratios of at least 2 to 1 to stand up to the human player.

Limited Information

Another way to make up for the computer's lack of intelligence is to

limit the amount of information available to the human player. If the human does not have the information to process, he cannot apply his superior processing power to the problem. Applying this technique to excess can reduce the game to one of chance. Used with discretion, however, limited information can equalize the odds between the player and the computer. If the information is withheld in a reasonable context (e.g., the player must send out scouts), the restrictions on information not only seem natural, but they add to the realism and excitement of the game.

Game designers often overlook or misunderstand the value of limited information. Limited information can tickle the imagination of the player by suggesting details without actually confirming them. You must artfully choose the limitations on the information, however. Randomly assigned gaps are confusing and frustrating rather than tantalizing.

Pace

Controlling the pace of the game provides another way to even the balance between human and computer. The human may be smart, but the computer is much faster at performing simple computations. If the pace is fast enough, human players will not have enough time to apply their superior processing skills and will be befuddled. This is a very easy technique to apply, so it comes as no surprise that many designers of skill and action games use it heavily.

These four techniques—vast resources, artificial reckoning, limited information, and pace—are never used in isolation; every game uses some combination of the four. Most games rely primarily on pace and vast resources for balance, with very little artificial reckoning or limited information. The reason for this emphasis is simple: pace and vast resources are easy to implement, while artificial reckoning and limited information are more difficult. Economy of effort

is no longer justifiable in the lucrative market for games. There's no reason why a game could not incorporate all four techniques; indeed, this should make the game all the more successful, for by using small amounts of each method, the game need not strain the limitations of any one method. The designer must decide the appropriate balance of each for the goals of the particular game.

Relationships Between Opponents

The concepts I've discussed so far apply primarily to computer games. Now let's consider some general game theory. Every game establishes a relationship between opponents that each player strives to exploit to maximum advantage. The fundamental architecture of this relationship, *symmetric* or *asymmetric*, plays a central role in the game. The simplest architecture establishes a *symmetric relationship* between the two players. Both possess the same properties, the same strengths and weaknesses. Symmetric games have an obviously desirable feature: they are automatically balanced. Because the same processes are applied to each player, symmetric computer games tend to be easier to program. Finally, these games are easier to learn and understand. Examples of symmetric games include Combat for the Atari 2600, Basketball, and Dog Daze.

Symmetric games suffer from a variety of weaknesses, the greatest of which is their relative simplicity. Any strategy that promises to be truly effective can and will be used by both sides simultaneously. In such a case, success derives not from planning but from execution. Alternatively, success in the game turns on very fine details. Chess provides an example: an advantage of but a single pawn can be parlayed into a victory.

Because of the weaknesses of symmetric games, many game designers attempt to establish an *asymmetric relationship* between the opponents. Each player has a unique combina-

tion of advantages and disadvantages. The game designer must somehow balance the advantages so that both sides have the same likelihood of victory, given equal levels of skill. The simplest way of doing this is with plastic asymmetry. Games incorporating this relationship are formally symmetric, but the players select initial traits according to some set of restrictions. For example, in the board game Wizard's Quest the players have the same number of territories at the beginning of the game, but they choose their territories in sequence. Thus, what was initially a symmetric relationship (each player is entitled to n territories) becomes an asymmetric one (player A has one

Symmetric games suffer from their relative simplicity.

combination of n territories while player B has a different combination). The asymmetry is provided through the choices of the players themselves at the outset of the game, so if the results are imbalanced, the players are responsible.

Other games have a more explicitly asymmetric relationship. Almost all solitaire computer games establish an asymmetric relationship between the computer player and the human player because the computer cannot hope to compete with the human in matters of intelligence. Thus, the designer gives resources to the human player allowing the use of his or her superior planning power, while the computer gets resources that compensate for its lack of intelligence.

The advantage of asymmetric games lies in the ability to build nontransitive or triangular relationships into the game. Nontransitivity is a well-defined mathematical property. In this context, it is best illustrated with the rock-scissors-paper game. Two players play this game; each secretly

selects one of the three pieces; they simultaneously announce and compare their choices. If both make the same choice the result is a draw and the game is repeated. If they make different choices, then rock breaks scissors, scissors cut paper, and paper enfolds rock. This relationship, in which each component can defeat one other and can be defeated by one other, is a nontransitive relationship; the fact that rock beats scissors and scissors beat paper does not mean that rock beats paper. This particular nontransitive relationship only produces clean results with three components so that each component relates to only two other components; it beats one and loses to the other. A rock-scissors-paper game with binary outcomes (win or lose) cannot be made with more than three components. You could make a game with multiple components if several levels of victory (using a point system, perhaps) were included.

Nontransitivity is an interesting mathematical property but it does not yield rich games if we hew to the strict mathematical meaning of the term. Its value to game design lies in the generalization of the principle into less well-defined areas. I use the term "triangular" to describe such asymmetric relationships that extend the concepts of nontransitivity beyond its formal definition.

A simple example of a triangular relationship appears in the game Battlezone. When a saucer appears, the player can pursue the saucer instead of an enemy tank. In such a case, there are three components: player, saucer, and enemy tank. The player pursues the saucer (side one of the triangle) and is pursued by the enemy tank (side two). The third side of the triangle (saucer to enemy tank) is not directly meaningful to the human—the computer maneuvers the saucer to entice the human into a poor position. This example is easy to understand because the triangularity assumes a spatial form as well as a structural one.



Photo 4: *Eastern Front 1941* is a World War II game whose design incorporates one major trick. Once you learn the trick, mastery of the game becomes possible.

Triangularity is most often implemented with mixed offensive-defensive relationships. In any conflict game, players must make offensive and defensive actions. Some games concentrate the bulk of a certain activity on one side, making one player the attacker and the other player the defender. This game design is risky, for some people do not enjoy playing a single role, especially that of defender, throughout an entire game. After all, the defender can only lose status and never gain any. Much more entertaining are games that mix offensive and defensive strategies for each player. This way, each player gets to attack and to defend. What is more important, players can trade off defensive needs against offensive opportunities. Triangular relationships automatically spring from such situations.

The essential value of triangularity lies in its indirection. A binary relationship makes direct conflict unavoidable; the antagonists must approach and attack each other through direct means. These direct approaches are obvious and expected

and such games often degenerate into tedious exercises following a narrow script. A triangular relationship allows each player indirect methods of approach. The indirect approach always creates a far richer and subtler interaction.

Positive Monotonic Curve

An important trait of any game is a positive monotonic curve of results as a function of effort. Although my lumbering expression of the idea sounds imposing, its meaning is far simpler: as players work with a game, their scores should reflect steady improvement. Beginners should be able to make some progress, intermediate people should get intermediate scores, and experienced players should get high scores. If I were to make a graph of a typical player's score as a function of time spent with the game, that graph should show a curve sloping smoothly and steadily upward. I describe such a game as having a positive monotonic curve.

A variety of learning curves can arise. A game that has a relatively flat curve is hard to learn. If the curve is

steep, the game is easy to learn. If the curve has a sharp jump in it, apparently there is just one trick to the game, mastery of which guarantees mastery of the game. (*Eastern Front 1941* is a good example of such a game.) If the game has many sharp jumps, we say that there are many tricks. In all cases, the most desirable trait is a positive monotonic learning curve.

The designer works a positive monotonic curve into a game by providing a smooth progression from the beginner's level to an expert level. To do this, the game designer must create not one game but a series of related games. Each game must be intrinsically interesting and challenging to the level of player for which it is targeted. Ideally, the progression is automatic; players start at the beginner's level and the advanced features are brought in as the computer recognizes proficient play. More commonly, players must declare the level at which they desire to play.

Games without a positive monotonic curve frustrate players by failing to provide them with reasonable opportunities for bettering their scores. Players feel that the game is either too hard or too easy. Positive monotonic games challenge players at all levels and encourage continued play by offering the prospect of new discoveries. *Tempest* is an excellent example of such a game.

The Illusion of Winnability

An important trait of any game is the illusion of winnability. If a game is to provide a continuing challenge to players, it must also provide a continuing motivation to play. The game must appear to be winnable to all players, beginners and experts, but it must never be truly winnable or it will lose its appeal. This illusion is very difficult to maintain. Some games maintain it for the expert but never achieve it for the beginner; these games intimidate all but the most determined players. The most successful game in this respect is *Pac-*

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Man, which appears winnable to most players, yet is never quite winnable. Tempest, on the other hand, intimidates many beginners because it appears to be unwinnable.

The simplicity or cleanliness of the game is the most important factor in creating the illusion of winnability. A dirty game intimidates its beginners with an excess of details. Many beginners never overcome the inhibiting suspicion that somewhere in the game lurks a "gotcha," some complicating detail or hidden factor that they haven't yet discovered. By contrast, a clean game encourages all players to experiment with the game as it appears.

Another key factor in maintaining the illusion of winnability arises from a careful analysis of the source of player failure. In every game the players are expected to fail often. What trips up the players? If they

believe their failure is caused by some flaw in the game or its controls, players become frustrated and angry with what they rightly judge to be an unfair and unwinnable situation. If players perceive their failure to be a result of their own limitations and decide that winning the game requires superhuman performance, they reject the game as unfair and unwinnable. But if players perceive failures to be attributable to correctable errors on their own part, then they believe the game to be winnable and play on in an effort to master the game.

Summary

In this article I have described a number of design factors and ideas that I have used in developing several games. These should not be used in grab-bag fashion, for taken together they constitute the elusive element we call technique. Technique is part of

an artist's signature, as important as theme. When we listen to Beethoven's majestic Fifth Symphony, the rapturous Sixth, or the ecstatic Ninth, we recognize in all the identifying stamp of Beethoven's masterful technique. If you would be a computer game designer, you must establish and develop your own technique. ■

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Ricochet

Gregg Williams
Senior Editor

Given the unique resources of microcomputers, you'd think someone would come up with an entirely new approach to game playing. Unfortunately, design innovations in video games are all too rare; we see new maze games, new shoot-'em-up games, and new adventure games, but seldom anything that stretches the imagination. There's a reason for this: adapting an existing, commercially proven idea and then programming for six months is much easier than agonizing over a new concept, programming for six months, and hoping for the best. Fortunately, a few brave souls thrive on the challenge of charting new territory. Thanks to two of them, we have a game called Ricochet.

I cannot find enough good things to say about Ricochet. It's easily the most original game I've seen this year, it's fun to play, and on top of that it's very modestly priced (under \$20, often discounted to about \$16). Available for three of the most popular microcomputers—the Apple II, the Atari 400/800, and Radio Shack TRS-80 Models I and III—the game has graphics, sound, and (on the Apple and Atari versions) color. You can choose from five game variations and play against a human or one of four computer opponents. And one of Ricochet's most interesting features is that it dynamically handicaps the more skillful of the two players to keep the game challenging even with players of widely varying skills. What more could you possibly want?

Before you rush out to buy Ricochet, you should know that it's not likely to be the favorite of the arcade set. Although it has arcade-like elements in it, Ricochet is primarily a game of strategy. Let's take a look at it.

Playing Ricochet

The Atari game board for Ricochet is shown in photo 1; the Apple and TRS-80 versions look somewhat different but play almost the same. The two players, Left and Right, start the game with two bumpers (the hourglass-shaped pieces at the left and right edges of the

screen) and two launchers each (one in each corner of the screen). The launcher can fire a launch (ball) that ricochets off the pieces (straight bars) and both players' bumpers; a launch is complete when it veers off the screen or hits any launcher. Pieces deflect the launch by 90 degrees, then immediately turn 90 degrees themselves. A move consists of firing a launcher or moving one or more pieces in the same direction (up, down, right, or left). You gain points for hitting any pieces or your opponent's launchers or bumpers; you lose points for hitting your own launchers or bumpers.

Although there are a few more rules I'll explain later, the paragraph above covers the behavior of most of the game. But no amount of rules can possibly convey how

Photo 1: Ricochet in progress. Photos 1a through 1c show the state of the board before, during, and after activation of the launcher in the lower left-hand corner. See the article for further details.

1a



much fun Ricochet is to play. The word that best describes my reaction to it is "delight." Rarely have I played a game that pleased me as much as Ricochet. No matter how good you are at visualizing what certain launches will do, some of them may remain in play much longer than you expect or hit an unexpected target. But even when the surprise costs you points, it's so much fun that you don't really mind.

Photos 1a through 1c show a simple example of a Ricochet launch in action. At the beginning of the move, the board is as shown in photo 1a. Left shoots his lower launcher; the launch bounces off pieces C and E (increasing Left's score by two points), hits the top wall of the game field, and ricochets into Right's top bumper. Photo

No matter how good you are at visualizing what certain launches will do, some of them may remain in play much longer than you expect.

1b shows the game board just as the launch hits the top right bumper; notice that pieces C and E have rotated 90 degrees. Left then scores 10 points for hitting the bumper, and the launch hits pieces H and J (which rotate and contribute two more points) before exiting off the right edge of the screen. Photo 1c shows the final result. And that's a *simple* shot in Ricochet. I've seen shots that ricochet 25 or even 50 times before ending and have launched shots that accumulate 20 points only to hit my own bumpers and disable the original launcher.

1b



Ricochet in the Long Run

The sequence of Ricochet described above is a match; it ends when one player can no longer shoot or if both launchers are either temporarily disabled or empty. The player with more points wins the match, and in the basic version of the game, play continues until one player wins two matches.

Now comes the fun part: Ricochet has a self-handicapping feature that enables players of different skill levels to compete as equals. The player who loses a match has a bumper removed in the next one; because the winning player has half as many bumpers to score from (one instead of two), winning the next game is harder for him. And if the winning player wins by a substantial margin, the value of his bumpers and launchers increases to a number *above* 10, which makes it easier for the losing player to win the next game. Ricochet also uses a "smart clock" that penalizes a player for playing more slowly than his opponent. These handicaps are all fine-tuned to make the players an equal match for each other even if they start at different skill levels. The more matches they play together, the more players become evenly matched. To carry the handicapping into future games, the computer issues a handicap rating to each player at the end of a game. If these values are typed in at the beginning of the next game, the players start the game more evenly matched.

Ricochet has a total of five variants, all of which are sufficiently different to warrant different strategies. You can play opposite a human opponent—in which case the program acts as a scorekeeper and referee—or against one of four computer "opponents," each of which has a distinct playing style. I found the computer players very difficult to beat, so you don't have to have a human op-

1c



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ponent to enjoy playing Ricochet. The 20 different games (5 variants multiplied by 4 possible computer opponents) available for solitaire play are sufficiently varied to keep you interested in the game.

Versions of Ricochet

Ricochet is available in both cassette and floppy-disk versions for the TRS-80 and Atari and in a floppy-disk version for the Apple II. I played the game on all three computers (disk-based versions for the TRS-80 and Apple II, cassette version for the Atari). The Apple version requires Applesoft BASIC and 48K bytes of memory, the other two disk versions require BASIC and 32K bytes of memory, and the cassette versions require BASIC and 16K bytes of memory. The Atari cassette version loads in two steps to help prevent unauthorized copying and takes an excruciatingly slow 10 minutes to load; prospective cassette-based users are hereby warned.

Although it has very little sound and color, the Apple version has the smoothest graphics. The TRS-80 and Atari versions, on the other hand, use character-sized graphics that don't create an illusion of continuous movement. The Atari version has the best sound and color, but

At a Glance

Name
Ricochet

Type
Strategy game

Manufacturer
Automated Simulations
1043 Kiel Court
Sunnyvale, CA 94086

Price
\$19.95

Authors
Bernie De Koven and Jeff Connelley

Format
Cassette tape or floppy disk

Language
BASIC

Computer Needed
Radio Shack TRS-80 Models I or III with 16K bytes of memory (cassette) or 32K bytes of memory (disk), Apple II with Applesoft or Apple II Plus with 48K bytes of memory (disk), Atari 400 or 800 with BASIC cartridge and 16K bytes of memory (cassette) or 32K bytes of memory (disk)

Documentation
8-page instruction manual and separate loading instructions

Audience
Strategy game enthusiasts, any age

BYTE GAME GRID

it plays more slowly than the Apple version and, paradoxically, penalizes you more quickly for not moving. (These differences are probably due to the idiosyncrasies of the different versions of BASIC in each machine; Ricochet is written in BASIC.) The TRS-80 version has the coarsest graphics and no color, but it makes some sound available through the cassette port (the sound is available even though the TRS-80 documentation doesn't mention it). Incidentally, the limitations of TRS-80 graphics make the pieces appear shorter when they are vertical than when they are horizontal, which, until you get used to it, may lead you to believe a path is blocked by pieces when it really isn't.

The Philosophy of Ricochet

I can tell from my own experience with game development that Ricochet was well designed and then polished for maximum playability. Such attention to detail is rare; most people release a game as soon as the program is free of programming errors—of course, that accounts for the countless mediocre games that are being sold today. As a result, you enjoy playing Ricochet even if you lose; you leave the game feeling satisfied instead of embittered.

That Ricochet is a game player's delight is really no surprise, because it was designed by Bernie De Koven and Jeff Connelley, both experienced game designers. De Koven's wonderful book, *The Well-Played Game* (Anchor Press, 1978), expresses many of the ideals that are implemented in Ricochet. It's a must for prospective game designers.

Conclusions

Ricochet is not only a fantastic strategy game but a reasonably priced one as well. (Arcade-game enthusiasts, take note: it is neither visually stunning nor the conventional arcade variety.) Automated Simulations should be commended for creating a totally new kind of game that takes advantage of the computer's unique strengths and for selling it at a lower price than it could command.

Ricochet has five variations, four different computer opponents, and a human-versus-human option. It can be played as a casual or a serious game, and in either case it is delightful. Interactive handicapping makes the game a challenge regardless of your relative skill level. If Ricochet is indicative of Automated Simulations' offerings, I eagerly await the company's next release. ■

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One of the most powerful features of the Atari 400 and 800 computers is that they allow you to redefine the character set. Thus a creative programmer can design foreign-language alphabets, special symbol tables, or unique graphics characters for custom screen displays. This feature uses less memory than alternative Atari graphics modes and allows easy manipulation of characters in the form of text strings. Many of your favorite computer games use character graphics in BASIC mode 1 or the

hardware-only ANTIC 4 mode. In this article I shall explain how to use the elusive five-color ANTIC 4 mode because it offers the greatest graphics resolution and design challenge.

In brief review, the Atari computers support three text modes (GRAPHICS 0 through 2) and six graphics modes (GRAPHICS 3 through 8) accessible through Atari BASIC. (The new GTIA-chip-equipped computers have three additional graphics modes: GRAPHICS 9, 10, and 11.) But five more modes are available to BASIC programmers only through display-list modification. The display list is that set of instructions that determines how data found in screen memory will be displayed. Its beginning location in memory varies but can always be found in the pointers at memory locations 560 and 561 (230 and 231 hexadecimal). Both the display list and screen memory are subject to programmable modification.

While you may have heard of these hidden modes, few programmers take advantage of their unique features. The ANTIC 4 mode is very easy to

establish by means of a simple display-list modification, which can be accomplished by the program in listing 1. However, if you try to print text characters on the screen while in this mode they will be distorted and unreadable because in this mode character data is interpreted differently than in other text modes. The first time you use the ANTIC 4 or ANTIC 5 mode you will immediately see that normal character sets such as the one supplied with your computer just won't work. The best way to design a new character set, one that will work in ANTIC 4 mode, is to use a character-set editor, a program that will assist you in quickly designing a custom character set and saving it for future use. While several character editors are available commercially, none are specifically designed for use with ANTIC 4 and ANTIC 5 modes. The Character Graphics Editor will work with these modes.

Interpreting Character Data

A character set consists of 128 characters, each having an identifying character number and 8 bytes of

Editor's Note: The Atari personal computers incorporate several sophisticated features that allow tremendous flexibility in the design of computer-generated graphics. Readers who want more background information on display lists and character modification should consult the following articles: "An Introduction to Atari Graphics," (January 1981 BYTE, page 18); "The Atari Tutorial, Part 1: The Display List," (September 1981 BYTE, page 284); and "The Atari Tutorial, Part 2: Graphics Indirection," (October 1981 BYTE, page 70). Other aspects of the Atari computers are covered in further articles in the Atari Tutorial series that appeared in BYTE from November 1981 through June 1982.

ATARI GRAPHICS

Listing 1: The ANTIC 4 Display-List Modifier program. Any text characters entered on the screen while this program is running will be unreadable.

```
10 REM ANTIC 4 Display List Modifier
20 GRAPHICS 0
30 DL=PEEK(560)+256*PEEK(561)
40 POKE DL+3,4+64
50 FOR I=0 TO 22
60 POKE DL+6+I,4
70 NEXT I
```

data that determine its shape. The character numbers, from 0 to 127 (called ATASCII numbers by Atari) are each stored as one byte in a program. The shape data for each character is stored permanently in the ROM (read-only memory) inside the computer. When you call GRAPHICS 0 mode and print text to the screen, the computer fetches 8 bytes of shape data for each character; each byte represents 8 bits of information for a total of 64 bits per character. Each byte of shape data is converted into an 8-bit binary number containing zeros and ones. A bit that is "on" (a number one) displays a dot. A bit that is "off" (a number zero) does not. In figure 1 you can see that the letter X has 24 on bits and 40 off bits. The computer dutifully displays the 24 on bits, which you perceive as the X character.

In ANTIC 4 mode, however, the 64 bits of character data are interpreted differently. The computer takes one byte at a time. Instead of breaking

down each byte into 8 separate bits, it takes 2-bit units, or bit pairs, and interprets each pair as a single dot in one of four colors (see figure 2). If neither bit in the pair is on, then the background color (whatever is in color register 4) is chosen and no dot appears on the screen. If a right-hand bit is on, the dot will be the color in register 0. If the left-hand bit is on, the dot will be the color in register 1. If both bits are on you will see a colored dot from register 2. (COLOR 1 comes from register 0, COLOR 2 from register 1, and so forth, except for COLOR 0, which comes from register 4.)

So, where the computer reads four bit pairs, four dots could be displayed for each byte with a choice of three colors, four if you count the background color. Characters are still 8 bytes tall, so you have 32 dots (or pixels, as they should be called) per character instead of 64, but the letters are not tall and skinny as you might expect. Each pixel in ANTIC 4 mode is twice as wide as in GRAPHICS 0 mode. The physical dimensions of the displayed character will be the same in either mode, and the screen still displays 40 characters per line by 24 lines.

Figure 3 is the ANTIC 4 mode interpretation of figure 2 showing how some dots in a character would be COLOR 1, some COLOR 2, and some COLOR 3. Such characters look confusing on the screen. We

have to redesign them if we are to use them in this mode.

Designing ANTIC 4 Characters

Usually redesigning an alphabetic character to read properly in ANTIC 4 mode requires working with one color at a time. Referring back to figure 1, use only bits in columns 0, 2, 4, and 6 for characters with register 0 color, and columns 1, 3, 5, and 7 for characters with register 1 color. If both bits of a pair are on, then a third color, from register 2, will be used. But with the Character Graphics Editor program, you won't have to worry about bit columns or register numbers. By choosing a color, either 1, 2, or 3, the editor automatically plots points in the right position. If the letter X were redesigned, it might look like one of the versions illustrated in figures 4 and 5. Each variation produces the same character (except for color) in ANTIC 4. Notice that bit pair 0-1 on the right was not used in these cases; the right bit-pair column was left blank for spacing between text characters. This is not necessary when designing graphics symbols, especially when combining two or more characters to make one large character. For example, you could redefine the letters C, A, and R to be the front, midsection, and back of an automobile. Multiple colors could be incorporated for detail and realism.

A fifth color can be achieved by de-

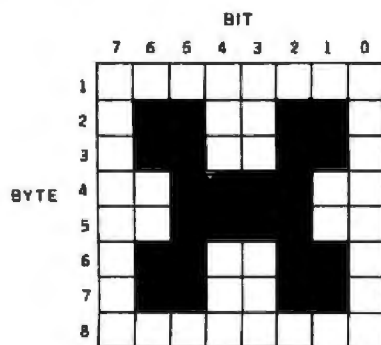


Figure 1: GRAPHICS 0 mode bit map for the X character. A character is composed of 64 bits, with selected bits turned on to display the character.

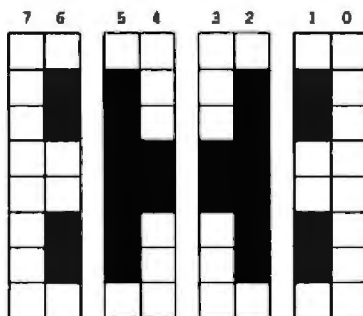


Figure 2: ANTIC 4 bit map for the X character. The bit map is divided into bit pairs for use by ANTIC 4 and 5 modes.

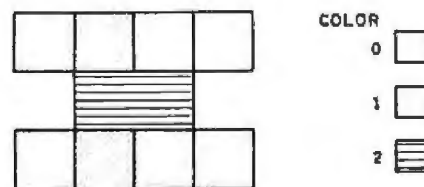
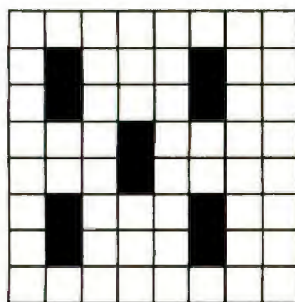
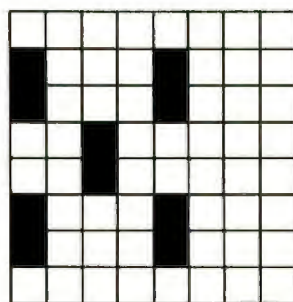


Figure 3: ANTIC 4 mode interpretation of figure 2. The configuration of the bit pairs determines the color on the screen.

ATARI GRAPHICS



A



B

Figure 4: Alternative configurations for bit pairs. If all the right-hand bits are on, as in A, the X would be the color in register 0, while the X in figure B would be the color in register 1.

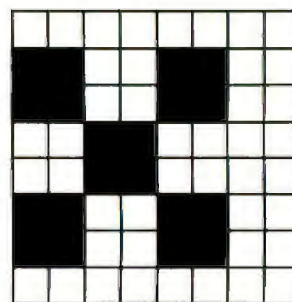


Figure 5: Inverse video character. By having all the bits in the bit pairs on and printing the character as an inverse video character you can obtain the color in register 3.

signing the character to have both bits in a bit pair on and printing the character as an inverse-video character (setting the most significant name bit). The X in figure 5, for example, if printed inverse, would be printed in the register 3 color. A single on bit, either left or right in a bit pair, will

not be affected by inverse video; only when both bits are on will the color switch with inverse printing. Using this technique you can have a total of four character colors plus the background color, just like GRAPHICS modes 1 and 2. ANTIC 4 mode allows the use of all 128 characters at

one time, whereas GRAPHICS 1 and 2 allow only 64 characters at a time.

ANTIC 5 mode is another hardware-only mode, just like ANTIC 4 except the characters are twice as tall. Twelve lines of ANTIC 5 mode characters will fit onto a full video display screen. The same redefined character

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ATARI GRAPHICS

Listing 2: The ANTIC 5 Display-List Modifier program. Characters entered on the screen will be displayed twice as tall as normal, again making them unreadable.

```
10 REM ANTIC 5 Display List Modifier
20 GRAPHICS 0
30 DL=PEEK(560)+256*PEEK(561)
40 POKE DL+3,5+64
50 FOR I=0 TO 10
60 POKE DL+4+I,5
70 NEXT I
80 POKE DL+17,65:POKE DL+18,PEEK(560)
POKE DL+19,PEEK(561)
```

set used in ANTIC 4 mode may be used for ANTIC 5 mode. The display-list modification is similar to that for ANTIC 4 mode (see listing 2). Although I have never seen ANTIC 5 mode used in a practical program, the tall text characters do offer exciting potential.

Listing 3 demonstrates multicharacter, multicolored graphic symbols; the special characters are incorporated into the program in the form of DATA statements. The program displays GRAPHICS 0, ANTIC 4,

and ANTIC 5 modes with five colors of characters. Look for the inverse video characters (underlined> in lines 110 and 140.

Character Graphics Editor

One way to design a character set is by hand. With lots of graph paper, colored pens, and imagination, you can design a set in an hour or so. Then you must convert the graphic data into numerical data and code it in a program as DATA statements. This isn't difficult, but it is very time consuming. With the Character Graphics Editor program, the Atari computer can handle all these tasks, except for supplying the imagination, so let it do the work. Type in listing 4, using inverse characters whenever you see an underlined character. Line 140 has an Escape/Control key sequence in braces that will cause a down arrow to appear on the screen during the program run. The pro-

gram requires 13K bytes of free RAM (random-access read/write memory).

If you've used other character editors before, you'll probably find this one different visually and operationally. You will need to understand how ANTIC 4 and ANTIC 5 modes interpret data, as previously explained, because you will be working with three colors in a 4-by-8-dot grid.

When you run the editor, the screen will be divided into five windows, each for a different mode. The top window (GRAPHICS 3) displays an enlarged character in two grids. The left grid is the working grid; the right grid is an 8-by-8-dot interpretation of the left grid. Below these is the instruction window; watch for prompts and the menu here.

Next is a mode-switchable window containing the entire 128-character set, and below that are two windows, ANTIC 4 mode and ANTIC 5 mode

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ATARI GRAPHICS

respectively, that will show actual-size samples of your design singularly, in inverse video, and in a multiple string. Plug a joystick into port 1, and you're ready to design.

Using the Editor

The character set initially loaded is the Atari standard set. The first character displayed, the letter A, doesn't look like a letter at all. Press C for clear. Your joystick movements will reposition the red cursor. Press the Fire button and a yellow dot will be plotted behind the cursor. (I know you'll want to move the cursor just to see if the dot is really there.) Press the button again and the dot will be erased. Select a color by pressing 1, 2, or 3. Atari's default colors (1 equals orange, 2 equals light green, and 3 equals blue) will be used for now. If you plot blue dots in the top window, the character's inverse color will be color 4, red. Using the SETCOLOR command, you can choose any character and background colors you wish in your own programs.

Press E to edit a different character. The Escape key, normally required to display some characters, isn't needed. The down arrow, for example, is displayed by pressing the Control and = keys simultaneously.

To save your character set as a data file, press S and enter a filename (cassette users should enter C: as a file-

name). Load a previously saved data file by pressing L and entering a filename. Pressing the Select key alters the display list so that the entire character set in the third window switches from GRAPHICS 0 to ANTIC 4 mode. Test any letter or character combination by pressing T and the inverse (Atari logo) key, if you wish.

Now that you have the tool to make a proper character set, put it to use in a practical program of your own. Type in either listing 1 for an ANTIC 4 screen or listing 2 for ANTIC 5. Add the following lines and you will be able to load and use your newly created graphics character set:

```
10 RAMTOP=PEEK(106):
   POKE 106,RAMTOP-8:
   CHBASE=RAMTOP+4
20 OPEN #1,4,0,"filename":
   REM change filename to
   the one you used.
200 FOR I=0 TO 1023:
   GET #1,D:
   POKE CHBASE+256+I,D:
   NEXT I
210 POKE 756,CHBASE
```

Special Features

The Character Graphics Editor program uses several features that greatly enhance the program execution speed and could be used in your own BASIC

programs. A machine-language display-list interrupt (DLI) service routine is loaded into page 6 of the computer's memory at initialization. It allows the use of the standard character set in the menu window while displaying custom characters in the lower half of the screen display. The service routine is called 60 times per second by the DLI instruction located in the modified display list. Without this feature the menu would be unreadable.

A second machine-language routine, only 6 bytes long, saves and loads the character set in a fraction of the time it would take if the program used PUT and GET commands in loops. It too is located in page 6 and is initiated by a USR call.

String manipulations are used to transfer the standard character set from ROM to RAM, where it can be altered. String manipulations are also used to transfer a string containing zeros into screen memory, thus clearing displays with machine-language speed.

Player-missile graphics, an extremely powerful feature of the Atari computers, is used for the cursor and the two grid patterns of the Character Graphics Editor screen display. The cursor is moved via another string manipulation that is so fast that a delay loop was necessary to slow it down to a usable speed.

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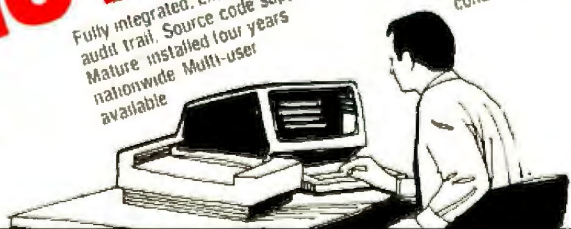
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Listing 4 continued:

```

420 IF D>63 THEN D=D-64:F=F+1:COLOR 1:
PLOT 28,B:PLOT 8,B:PLOT 9,B:A(A,1)=64:
A(A,B)=A(A,B)+A(A,1)
430 IF F>1 THEN COLOR 3:PLOT 27,B:PLOT
28,B:PLOT 8,B:PLOT 9,B
440 F=0:IF D>31 THEN D=D-32:F=F+1:COLR
2:PLOT 29,B:PLOT 10,B:PLOT 11,B:A(A,
2)=32:A(A,B)=A(A,B)+A(A,2)
450 IF D>15 THEN D=D-16:F=F+1:COLOR 1:
PLOT 30,B:PLOT 10,B:PLOT 11,B:A(A,3)=1
6:A(A,B)=A(A,B)+A(A,3)
460 IF F>1 THEN COLOR 3:PLOT 29,B:PLOT
30,B:PLOT 10,B:PLOT 11,B
470 F=0:IF D>7 THEN D=D-8:F=F+1:COLOR
2:PLOT 31,B:PLOT 12,B:PLOT 13,B:A(A,4)
=B:A(A,B)=A(A,B)+A(A,4)
480 IF D>3 THEN D=D-4:F=F+1:COLOR 1:PL
OT 32,B:PLOT 12,B:PLOT 13,B:A(A,5)=4:A
(A,B)=A(A,B)+A(A,5)
490 IF F>1 THEN COLOR 3:PLOT 31,B:PLOT
32,B:PLOT 12,B:PLOT 13,B
500 F=0:IF D>1 THEN D=D-2:F=F+1:COLOR
2:PLOT 33,B:PLOT 14,B:PLOT 15,B:A(A,6)
=2:A(A,B)=A(A,B)+A(A,6)
510 IF D>0 THEN F=F+1:COLOR 1:PLOT 34,
B:PLOT 14,B:PLOT 15,B:A(A,7)=1:A(A,B)=
A(A,B)+A(A,7)
520 IF F>1 THEN COLOR 3:PLOT 33,B:PLOT
34,B:PLOT 14,B:PLOT 15,B
530 NEXT A:GOSUB 220:RETURN
800 REM TEST CHARACTERS
810 GOSUB 180:POSITION 5,0:?"Your typ
ed characters":POSITION 7,1:?"will ap
pear below.  NORMAL"
820 POSITION 2,2:?"- Press RETURN f
or menu -":
830 D=1:POKE 764,255:CLEAR%:=ZERO%:GOS
UB 480
840 IF PEEK(764)=255 THEN B40
850 IF PEEK(764)=39 OR PEEK(764)=103 T
HEN 900
860 GET #3,CHR:IF CHR=155 THEN GOSUB 4
80:CLEAR%:=ZERO%:GOSUB 220:POKE 694,0:
RETURN
870 GOSUB 240:POSITION D,1:?"CHR$(27):
CHR$(CHR):GOSUB 250:POSITION D,1:?"CHR
$(27):CHR$(CHR)
880 D=D+1:IF D>38 THEN D=1
890 POKE 764,255:GOTO 840
900 POKE 694,128*(PEEK(694)=0):POKE 53
279,0:GOSUB 220
910 IF PEEK(694)=128 THEN POSITION 29,
1:?" INVERSE "
920 IF PEEK(694)=0 THEN POSITION 29,1:
?" NORMAL "
930 POKE 764,255:GOTO 840
1000 REM LOAD CHARACTER SET
1010 GOSUB 1080:TRAP 1140:OPEN #1,4,0,
FILE#:POKE 850,7:GOSUB 1120:RETURN
1080 POKE 752,0:GOSUB 220:GOSUB 180:PO
SITION 1,0:?"Enter filename. (e.g. D1
:FILENAME.SET)"
1090 POSITION 11,1:INPUT FILE#:POKE 75
2,1:GOSUB 180:RETURN
1100 REM SAVE CHARACTER SET
1110 GOSUB 1080:TRAP 1140:OPEN #1,8,0,
FILE#:POKE 850,11:GOSUB 1120:RETURN
1120 POKE 852,0:POKE 853,CHBASE/256:PO
KE 856,0:POKE 857,4:POKE 756,CHBASE/25
6:A=USR(1555)
1130 CLOSE #1:TRAP 40000:POKE 54286,19
2:POKE 756,224:RETURN
1140 GOSUB 180:POSITION 1,1:?"CHR$(253
)":?"Bad connection or improper filename
":FOR D=1 TO 600:NEXT D:GOTO 1130
1200 REM JOYSTICK
1210 A=STICK(0):B=STRIG(0)
1220 IF A=7 THEN X=X+B:IF X>24 THEN X=
0
1230 IF A=11 THEN X=X-B:IF X<0 THEN X=
24
1240 IF A=14 THEN Y=Y-4:IF Y<20 THEN Y
=48
1250 IF A=13 THEN Y=Y+4:IF Y>48 THEN Y
=20
1260 POKE 53251,X:Y:56:A%:=0*(81-Y,81-Y+1
28)
1270 IF B=1 AND A<15 THEN GOSUB 80
1280 IF PEEK(764)>255 THEN GOSUB 1400
1290 IF PEEK(53279)=5 THEN FOR D=0 TO

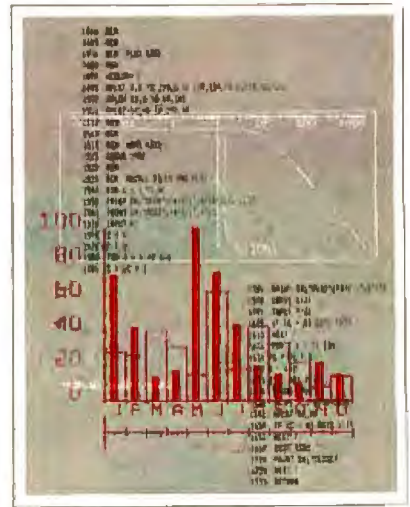
```

```

3:POKE DL+D+19,4*(PEEK(DL+D+19)=2)+2*(
PEEK(DL+D+19)=4):NEXT D
1300 IF B=0 THEN GOSUB 300
1310 GOTO 1200
1400 REM KEYBOARD CHECK
1410 GOSUB 220:GET #3,KEY:IF KEY=76 TH
EN GOSUB 1000:GOSUB 100
1420 IF KEY=83 THEN GOSUB 1100:GOSUB 1
00
1430 IF KEY=69 THEN GOSUB 400
1440 IF KEY=67 THEN GOSUB 470
1450 IF KEY=84 THEN GOSUB 800:GOSUB 10
0
1460 IF KEY=77 OR KEY=32 THEN GOSUB 10
0
1470 IF KEY=49 THEN C=1
1480 IF KEY=50 THEN C=2
1490 IF KEY=51 THEN C=3
1500 POKE 764,255:RETURN
1600 REM INITIALIZATION
1610 RAHTOP=PEEK(106)-12:POKE 89,RAHTO
P:POKE 88,0:?"CHR$(125):C=1:CHR=65:OPE
N #3,4,0,"K":
1620 POKE 106,RAHTOP:CHBASE=(RAHTOP+B)
*256:PMBASE=(RAHTOP+4)*256:GRAPHICS 0:
POKE 710,176
1630 POKE 203,CHBASE/256:POSITION 9,3:
?" INITIALIZING PROGRAM":GOSUB 490
1640 FOR A=0 TO 24:READ B:POKE 1536+A,
B:NEXT A:POKE 512,0:POKE 513,6
1650 VT=PEEK(134)+256*PEEK(135):AT=PEE
K(140)+256*PEEK(141)
1660 X=CHBASE-AT:Y=57344-AT:GOSUB 1800
1670 POKE VT+2,X2:POKE VT+3,X1:POKE VT
+4,1:POKE VT+5,4:POKE VT+6,1:POKE VT+7
,4
1680 POKE VT+10,Y2:POKE VT+11,Y1:POKE
VT+12,1:POKE VT+13,4:POKE VT+14,1:POKE
VT+15,4:A%=0%
1690 X=PMBASE+896-AT:Y=PMBASE-AT:GOSUB
1800:POKE VT+2,X2:POKE VT+3,X1:POKE V
T+10,Y2:POKE VT+11,Y1
1700 X=PEEK(88)+256*PEEK(89)+100-AT:Y=
RAHTOP*256-AT:GOSUB 1800:POKE VT+18,X2
:POKE VT+19,X1:POKE VT+26,Y2
1710 POKE VT+27,Y1:X=PEEK(88)+256*PEEK
(89)-AT:GOSUB 1800:POKE VT+34,X2:POKE
VT+35,X1
1720 X=PEEK(88)+256*PEEK(89)+380-AT:GO
SUB 1800:POKE VT+42,X2:POKE VT+43,X1
1730 FOR A=4 TO 44 STEP 8:FOR B=0 TO 3
:READ D:POKE VT+A+B,D:NEXT B:NEXT A:GO
TO 2000
1800 X1=INT(X/256):X2=INT(X-(256*X1)):
Y1=INT(Y/256):Y2=INT(Y-(256*Y1)):RETUR
N
2000 REM PLAYER/MISSILE GRAPHICS
2010 POKE 54279,PMBASE/256
2020 FOR D=53248 TO 53255:READ X:POKE
D,X:NEXT D:FOR D=53256 TO 53258:POKE D
,1:NEXT D:POKE 53259,3:X=0
2030 FOR A=0 TO 256 STEP 128:FOR D=20
TO 52 STEP 4:POKE PMBASE+512+A+D,21:NE
XT D:NEXT A
2040 FOR D=22 TO 50 STEP 4:POKE PMBASE
+384+D,85:NEXT D:POKE 623,17
2050 Y=20:FOR D=0 TO 3:POKE PMBASE+D+Y
+896,3:NEXT D:FOR D=0 TO 3:POKE PMBASE
+D+80,3:NEXT D
2200 REM ESTABLISH DISPLAY SCREEN
2210 GRAPHICS 0:POKE 752,1:POKE 711,68
:DL=PEEK(560)+256*PEEK(561):HOME=PEEK(
DL+4)+256*PEEK(DL+5):POKE DL+3,72
2220 FOR D=0 TO 8:POKE DL+D+6,8:NEXT D
:POKE DL+18,144:POKE DL+23,4:POKE DL+2
4,4:POKE DL+25,5:POKE DL+26,5
2230 POKE DL+27,65:POKE DL+28,PEEK(560
):POKE DL+29,PEEK(561):POKE 54286,192
2240 GOSUB 230:POSITION 4,0:FOR F=0 TO
3:FOR D=0 TO 31:?"CHR$(27):CHR$(D+32*
F):NEXT D:?" NEXT F
2250 POKE 559,46:POKE 53277,3:GOSUB 53
0:GOSUB 220:GOSUB 100:FOR D=0 TO 2:POK
E 704+D,6:NEXT D:POKE 707,68:GOTO 1200
2400 DATA 72,138,72,152,72,165,203,141
,10,212,141,9,212,104,168,104,170,104,
64,104,162,16,76,86,228
2410 DATA 128,0,128,0,128,1,128,1,120,
0,120,0,160,0,160,0,100,0,100,0,160,0,
160,0
2420 DATA 149,161,173,56,83,91,99,107

```

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Apple dictate where new stores could be opened.

Former Mail-Order Dealer Sues HP: Computer Place Inc., Carmel, California, has filed an antitrust suit against HP (Hewlett-Packard) alleging that the company is stopping mail-order distribution of personal computer and calculator products. Computerland was named as a codefendant. Computer Place alleges that HP stopped supporting dealer national advertising and refused to make available its new HP-86 personal computer to dealers who would not support local customers. It also claims that this action forced it out of business. It is interesting to note that a similar action filed against Apple Computer by three of its former mail-order dealers was dismissed.

Price War Develops: Atari and Commodore have accelerated the low-end personal computer price war with discounts on software, peripherals, and even basic units. This is in response to Texas Instruments' \$100 rebate program. Atari is offering coupons good toward the purchase of software, while Commodore has reduced the base price of its VIC-20. The result is that both the VIC-20 and TI-99/4A can now be purchased for well under \$200. I have seen both units being offered by stores in my area for under \$180. It is likely that Tandy will soon reduce the price of its Color Computer.

At these prices, personal computers are close to the selling prices of computer games and are beginning to affect game sales. (Speculation is that this is why Atari is offering games coupons instead of a price reduction.) The dealer cost for a computer is now down around \$150; however, dealers rely

on sales of software and peripherals to make a profit. Commodore is boasting that it is now producing 70,000 VIC-20s a month and, even with the \$150 dealer price, is still making a healthy profit on each unit shipped. The question is how this will affect sales of Commodore's soon to be released Max game machine, which will carry a \$179 price tag.

In the meantime, the Timex/Sinclair 1000 (aka the Sinclair ZX81 with 2K-byte RAM), selling at just under \$100 and already being discounted, is taking sales away from Texas Instruments, Atari, and Commodore in nationwide chains such as K-Mart.

This price war is upsetting to several Japanese companies who were planning to offer low-end computers. NEC, which planned to introduce its PC-6000 with a \$450 price, is now going through a redesign to eliminate features and reduce the price. Also, NEC is rumored to be designing a very low cost machine to compete with the VIC-20. Matsushita's Panasonic subsidiary, which had already disclosed that it planned to retail two computers, the JR-100 and JR-200, in early 1983 with prices in the \$300 range, has postponed introduction until summer as these products go through redesign. Sanyo, however, expects to begin selling a machine next August that will compete with the Timex/Sinclair.

The price war is undeniably making it difficult for new companies to enter the low-end marketplace. And those that do plan to enter are being thrown off balance as to pricing and timing of their entries.

Software Marketing Changing: Did you know that more than 150 new programs are marketed each month? It's getting like the record and book publishing

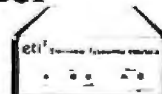
Do You Use a Printer or Modem?

The average microcomputer "moves" data at 120,000 characters a second. A typical disk drive transfers it at 27,000 CPS. Most printers however plod along at 100 CPS and many modems squeak out 30 CPS. That's quite a drop in efficiency not to mention a waste of computing power!



We've broken this bottleneck with a smart little "white" box called the PRINTER OPTIMIZER that features a 64,000 to 256,000 character memory buffer. Now you can "print" your inventory in 2 seconds instead of 10 minutes, and no longer will your computer be tied up transmitting or receiving modem transmissions. The OPTIMIZER is smart too. You'll notice a keypad and display in our picture. You can tell the OPTIMIZER to convert data, send control sequences, pause on cue, and more. For example: access all of your printer's capabilities (graphics, font size, forms control, special symbols) with the ease of selecting a station on a pushbutton car radio. Use it to adapt an XYZ printer to your ABC computer running a PDQ word processing program. Run a serial printer or modem from a parallel port. If you can afford and justify a disk drive, then you certainly need our OPTIMIZER to bring your printer, plotter or modem "up to speed" with the rest of your system.

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...then consider our affordable yet high quality alternative. Our MEDIAMIX ETI² converts an IBM Electronic Typewriter (and some other brands) into a computer printer. Every office needs a typewriter. So for example, you can buy an IBM Model 50 ET that costs about \$1200 and have a superior typewriter, and then with our ETI² have a printer that produces probably the highest quality printed image available. You can even do typesetting like this ad! And for financial printing you can't beat a wide carriage IBM ET. It's a truly cost effective investment. There are a number of arguments in favor of choosing this route over a single use computer printer, and we have an article on this subject you should read.

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industries. Word-processing programs, for example, already number more than one hundred, and the competition is becoming intense.

Software suppliers trying to establish brand names are providing slick packages for their products. The plain plastic sandwich bags will soon be a thing of the past, as software packages look more and more like record packages. In addition, suppliers are upping ad budgets and increasing promotional efforts, all of which serves to jack up the retail price.

But purchasers often have had trouble getting programs to work properly. Suppliers are finally beginning to face the problem by offering service with the product. For example, Peachtree Software now provides 30 days of free consultation with its software.

Currently, about half of all software is purchased via mail order. However, some experts are betting that this will shift to stores that will sell software much as record shops sell records: customers can walk in and see a demonstration of the software packages before they buy.

Unix On 8-Bit Systems:

We see an awful lot of promotion for Unix-like systems on 16-bit computers, particularly 68000-based machines. However, it is worth noting that Unix-like systems are also available on 8-bit machines. For example, several suppliers of 6809-based systems are furnishing the Uniflex operating system from Technical Systems Consultants (Chapel Hill, North Carolina). Also, Morrow Designs, located in Richmond, California, offers its Micronix operating system for the Z80-based Decision I.

Both of these systems offer multiuser, multitasking capability with file management nearly identical to that of Unix. They use a shell that in-

cludes I/O redirection, pipes, and many other Unix-like features.

Motorola Announces 68000 Enhancements:

Motorola has announced that next year it plans to make available several new versions of its 16-bit 68000 microprocessor. Prototypes of some of these new parts are already being tested by potential customers.

First, Motorola will market a reduced-bus version called the 68008. It will have an external 8-bit data bus and reduced address space (1 megabyte), come in a 48-pin package, and operate with 6800 peripheral chips.

Next will be the 68010, a virtual-machine version of the 68000. It will be able to recover control of the machine after memory faults, so it can be used in a demand-paged environment. Virtual-memory support improves the 68000's ability to handle multiuser systems.

Last will be the 68020, a full 32-bit version of the 68000. It will have a 32-bit-wide data bus and an instruction cache memory. Consequently, it will run programs two to four times faster than the 68000.

IBM Aims To Fit A 370 Into A 68000:

According to a technical paper that appeared in a recent issue of IBM's *Journal of Research and Development*, researchers at IBM's Endicott, New York, facility are attempting to recode Motorola 68000 microprocessors to implement the functions of an IBM System/370. The 16-bit 68000 microprocessor was selected because it is microcoded and has seventeen 32-bit general-purpose registers. The full 370 would require about four times the microcode capability of the current 68000; however, the hope is that within a

few years a 370 will be encoded into one 68000. In the meantime, the research group intends to partition the 370 architecture among a number of 68000s, which will communicate over a local bus and share common local storage.

Japanese Adopt U.S. Software:

More and more Japanese personal computer systems are being introduced in the U. S., but the surprising thing is that they are using American software rather than Japanese-made software. For example, Hitachi, NEC, and Panasonic will soon introduce systems using Microsoft's MS-DOS operating system, while Sony, Mitsubishi, Sanyo, and Hitachi are using the CP/M operating system from Digital Research. Hitachi will use both the MS-DOS and CP/M disk operating systems.

Not only are Japanese companies contracting with U. S. firms to supply operating systems, they are also looking to them for languages and applications programs. Structured Systems Group, for example, has signed contracts to provide its accounting software for several Japanese computers.

Atari And Lucasfilms Enter Joint Venture:

Atari has announced the formation of a new company with Lucasfilms (creator of *Star Wars*, *The Empire Strikes Back*, and *Raiders of the Lost Ark*). Each firm has an equal share of the new venture. The first product will be a video game based on *Raiders of the Lost Ark*.

Getting Robots To Walk:

Currently, mobile robots get around on wheels or tank-like tracks. But research is under way at Carnegie-Mellon and Ohio State universities to develop walking robots. Although

humans take walking for granted, it is a highly complex task fraught with such problems as balance and coordination of many sequences of joint and leg movements.

It is hoped that computers can be taught to cope with this problem. The walking robot being developed at Carnegie-Mellon will have six legs. This work is being funded by the Defense Department. Work on walking robots is also being done in Japan and the Soviet Union.

Artificial Intelligence News:

The introduction of the Motorola 68010 upgraded 16-bit microprocessor and the recent use of the LISP language for writing applications programs may lead to the use of AI (artificial intelligence) techniques in applications programming. LISP has long been the language of the AI community. Although there have been a few implementations of LISP on 8-bit machines, they have had very limited performance, and anyone doing serious AI work was forced to use large mini-computers. This, however, appears to be changing.

For example, the University of Pittsburgh has developed "Internist 1," which, in a test at Massachusetts General Hospital in Boston, proved almost as capable at diagnosing some diseases as physicians. Although currently running on a very large computer, this program is now being transported to run on several 68000-based microcomputers. Also, Cognitive Systems Inc., an offshoot of the Yale artificial-intelligence lab, has developed programs for stockbrokers, paralegals, accountants, and tax advisors that are already running on the 68000-based Apollo computer (Apollo Computer Inc., North Billerica, Massachusetts).

Ask BYTE

Conducted by Steve Clarcla

Magnetic-Tape Standard

Dear Steve,

I built an FSK (frequency-shift keyed) cassette interface for my homebrewed 8080-based microcomputer. Do you know of a standard or frequently used format for recording data on magnetic tape? I want my system to be compatible with commercial software.

Michael D. Zahorik
New Berlin, WI

One of the problems with the personal computer industry is its lack of standards. A format known as the Kansas City Standard is used on many 8080-type systems. This standard, named after the location of the conference that established it, uses 1200 Hz to indicate a 0 and 2400 Hz to indicate a 1. These frequencies were chosen to be compatible with the bandwidth and frequency response of typical cassette recorders. With the homebrew FSK system for your computer and this information, you should have no trouble with compatibility.
... Steve

Increasing Line Counts

Dear Steve,

In the March 1982 BYTE, you responded to a letter about high-speed printers (see "High-Speed Printers," page 442). You stated that the IBM laser printer is capable of 1800 lpm (lines per minute); however, IBM claims 1000 pages in 6 minutes, or approximately 11,000 lpm (almost 6 times as fast as 1800 lpm).

Charles Gawthrop
Wilmington, DE

Thank you very much for your letter. I have received many responses to the decimal point error that crept into that Ask BYTE answer. The correct number should have been 18,000 lines per minute, and even that is not its maximum speed.

From IBM's literature, the following calculations can be made: "allows printing at either 6, 8, or 12 lines per inch. . . ." "can process, for example, 1000 11-inch-long pages in approximately 6 minutes of continuous printing, regardless of the number of lines per page."

Now, 11 inches/page $\times$ 12 lines/inch = 132 lines/page
1000 pages/6 minutes = 166.67 pages/minute
166.67 pages/minute $\times$ 132 lines/page = 22,000 lines/minute

In reality, with 6 or 8 lines per inch and 66 lines per page, the effective number of lines per minute will be less. . . .
Steve

No Joy In Stickville

Dear Steve,

I own an Atari 800, and I have been disappointed in the performance of Atari's joysticks. They are not accurate and don't always make a good electrical connection.

I have been trying to build my own using momentary switches to make the five connections needed for motion and firing. Do you know where I can buy the appropriate female plug needed for the Atari? Also, do you have any suggestions for building a joystick, or do you know any companies making better-quality Atari-compatible joysticks?

Thanks for your help. Your articles are great.

Louis Yelgin
Malden, MA

The connector used on the rear of the Atari for the joysticks is a 9-pin Type D subminiature. It's available from many of the mail-order houses that advertise in BYTE; look for Priority One Electronics and California Digital ads in any issue.

Wico, a company that manufactures parts for arcade games, makes a deluxe version of the Atari joystick. It is large, solidly built, and has a trigger button on top of the stick, as well as one in the normal position. Order the Command Controller Joystick (part number: 15-9714) from Wico, 6400 West Grosse Point Rd., Niles, IL 60648, (312) 647-7500. . . .Steve

Shielding TV from Interference

Dear Steve,

I recently purchased the disk drive for the TRS-80 Color Computer. Since adding this device, I have experienced an annoying amount of interference on my television set. The drive's manual came with a flier warning that this problem might be present in some of the earlier machines and, if that was the case, you should return the computer to a service center for additional shielding.

I would prefer to make the modifications that might be necessary myself. Could you please give me an idea of what could correct this problem.

Thanks for whatever help you can give.
Richard D. Fothergill
Pittsfield, MA

The interference that you are experiencing with the TRS-80 Color Computer disk drive is probably caused by radiation from the cable that connects the drive to the computer. The cable is acting as an antenna, and to eliminate the radiation, it must be shielded. My article in the January 1981 BYTE, "Electromagnetic Interference" (page 48), describes the sources of electromagnetic interference and how to cure them.

Wrapping the disk-drive cable in several layers of aluminum foil and grounding the foil to the computer should be beneficial. But frankly, if Radio Shack has a free fix, I would let the service center do it. It will be neater and may help the resale value of the computer at some later date. . . .Steve

Chess Program for Home Brewers

Dear Steve,

I'd like to buy a chess-playing program for my computer. My problem is that I don't have a standard personal computer but two home-built systems. One is 6809-based, with keyboard and video display. The other is Z80-based, with 32K bytes of memory and plenty of space for 2716-type EPROMs (erasable programmable read-only memories).

I'd like to know how to change an existing chess program so that it could be run on my Z80-based computer and so that the input and output can be done through the 6809 computer, allowing it to process all communication with a human opponent.

game. Your creature, the Masher, must get all the creatures with numbers on their bodies into the correct order within the specified time limit. Four levels of difficulty. For the Apple II or II Plus; floppy disk, \$29.95. Piccadilly Software Inc., 89 Summit Ave., Summit, NJ 07901.

Test Writer, a program that produces multiple-choice tests of any length from a pool of questions developed by the user. Its automated index card system is useful for almost any subject. For the Apple II Plus; floppy disk, \$35. Persimmon Software, 502 C. Savannah St., Greensboro, NC 27406.

Tic Tac Show, a multi-player question-and-answer game program. You can enter your own questions and answers to develop a computer-assisted instruction game. Several different subjects can be stored on disk. For the Apple II; floppy disk, \$19.95. Computer Advanced Ideas, Suite 341M, 1442 A Walnut St., Berkeley, CA 94709.

The Tool, a business-applications program generator. This package handles all screen editing, field formatting, and entry validation. Includes a database manager and a report generator. Configured for use with BASIC. For the Apple II; floppy disk, \$395. High Technology Software, 2201 Northeast 63rd St., POB 14665, Oklahoma City, OK 73113.

Tunnel Terror, an arcade-type game. You are given three ships, and you must shoot down the center of the tunnel to prevent the enemy from destroying you. This game has 61 levels for up to four players. For the Apple II; floppy disk, \$29.95. Adventure International (see address above.)

The Wreck of the B. S. M. Pandora, a simulation game. You assume the role of a crewman trying to save your ship-

mates, a cargo of dangerous alien creatures, and your ship from a fatal accident. For the Apple II; floppy disk, \$50. Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

Atari

Airstrike, an arcade-type game. Fight your way through the alien cavern as you shoot or dodge missiles and bombs. Destroy the alien fighters as you traverse through the levels of the fortress. For the Atari 400 and 800; cassette, \$39.95. English Software Co., POB 3185, Redondo Beach, CA 90277.

Legionnaire, a real-time simulation game. Control the forces of the Roman Legions as you battle the Gaulish barbarians. The game features high-resolution graphics and sound. For the Atari 400 and 800; cassette, \$35. Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Pirate Adventure, a high-resolution adventure-type game. In this game, you attempt to go from your London flat to Treasure Island as you search for the long-lost treasure of Long John Silver. For the Atari 400 and 800; floppy disk, \$39.95. Adventure International, POB 3435, Longwood, FL 32750.

Preppie, an arcade-type game. You must retrieve golf balls from the world's toughest golf course, the Nasty Nine, or cease to be a preppie. For the Atari 400 and 800; floppy disk, \$29.95. Adventure International (see address above).

Sentinel, an arcade-type game. Your mission is to destroy the enemy's missile silos while protecting your cities from the incoming missiles. You must also destroy the strategic bombers and alien intruders. For the Atari 400 and 800; floppy disk, \$29.95. Med Systems

Software, POB 3558, Chapel Hill, NC 27514.

Soccer, an arcade-type game. This game uses high-resolution graphics to produce a real-time simulation of the game of soccer. Two, three, or four players can control opposing teams. For the Atari 400 and 800; floppy disk, \$29.95. Gamma Software, POB 25625, Los Angeles, CA 90025.

Text Editor, a line-oriented text editor. This simplified editor can be used as a word processor or as an editor for BASIC programs. Character line length is limited to 128 characters. For the Atari 400 and 800; floppy disk, \$25. Softcenter Industries, 26 Country Ridge Rd., Pomona, CA 91766.

Atari VCS

Barnstorming, an arcade-type game. Pilot your biplane through barns, over windmills, and around flocks of geese. The object is to get the quickest time for flying over the course. For the Atari VCS (video computer system); cartridge, \$31.95. Activision, Drawer 7286, Mountain View, CA 94042.

Berzerk, an arcade-type game. You are trapped in a series of electric mazes. If you touch the walls, you will be destroyed. To get out, you must dodge or shoot the robot guards. For one player. For the Atari VCS; cartridge, \$31.95. Atari Inc., 1196 Borregas Ave., POB 427, Sunnyvale, CA 94086.

Chopper Command, an arcade-type game. You control a chopper that's guarding a convoy of trucks delivering medical supplies. You must destroy the attacking enemy aircraft with your missiles. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Defender, an arcade-type

game. You must defend the Earth from attack by alien ships. Destroy the bombers, swarms, landers, and mutants. For the Atari VCS; cartridge, \$37.95. Atari Inc. (see address above).

Dragster, an arcade-type game. Race your dragster against another car and the clock. Your joystick becomes the clutch, gearshift, and gas pedal. For the Atari VCS; cartridge, \$22.95. Activision (see address above).

Frogger, an arcade-type game. The object is to get your frog across the road, over the river, and home. For the Atari VCS; floppy disk, \$30. Parker Brothers, POB 1012, Beverly, MA 01915.

Grand Prix, an arcade-type game. Control a Grand Prix race car and maneuver your vehicle around the course. The game features high-resolution graphics and sound. For one player. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Ice Hockey, an arcade-type game. You control your forward player to shoot the puck into the opposition's goal or defend your own goal. Game has automatic scorekeeping and timing. For one or two players. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Kaboom, an arcade-type game. The mad bomber is dropping bombs from a high wall. You must catch the bombs in buckets of water. For one player. For the Atari VCS; cartridge, \$22.95. Activision (see address above).

Laser Blast, an arcade-type game. You must destroy the invading aliens by blasting them with your laser. The longer you play, the more difficult the game becomes. For one player. For the Atari VCS; cartridge, \$22.95. Activision (see address above).

Megamania, an arcade-type game. You must shoot down

the alien objects, which include celestial dice, spinning bow ties, flying widgets, and hostile hamburgers. For one player. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Pitfall, an arcade-type game. Hidden in the jungle are several treasures. You must swing through trees, jump over bottomless pits, and journey through underground passages. For one player. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Skiing, an arcade-type game. Step onto the slopes for a skiing experience that ranges all the way from the beginner's slope to an Olympic downhill run. Beat your best time. For one player. For the Atari VCS; cartridge, \$22.95. Activision (see address above).

Starfighter, an arcade-type game. You are in the cockpit of a starfighter. Your mission is to defend your starbase from attacks and to search out and destroy the enemy's fighters. For one player. For the Atari VCS; cartridge, \$31.95. Activision (see address above).

Star Wars: The Empire Strikes Back, an arcade-type game. Based on the popular film, this game pits the Rebel Snowspeeders, controlled by the player, against the Imperial Walkers on the ice planet Hoth. For one or two players. For the Atari VCS and the Sears Video Arcade; cartridge, \$30. Parker Brothers (see address above).

Tennis, a graphics simulation game. You can rush the net, play the baseline, or roam the court in this version of tennis. The game provides automatic scorekeeping. For one or two players. For the Atari VCS; cartridge, \$22.95. Activision (see address above).

Volleyball, an arcade-type game. This simulation of volleyball follows standard

rules. The game uses setups and spiking. For one or two players. For the Atari VCS; cartridge, \$26.95. Atari Inc. (see address above).

CP/M

CP+, a user-friendly program that replaces CP/M commands with English-language "menus," messages, and directions. It provides you with a software print spooler, help option, and other functions. For CP/M-based systems; floppy disk, \$150. Taurus Software, Suite 815, 870 Market St., San Francisco, CA 94102.

Compare for CP/M-80, a utility program that locates and documents the differences between two text files. The files may be text or source-code files for programs in assembler, BASIC, PL/I, or other languages. For CP/M-based systems; floppy disk, \$105. Solution Technology Inc., Suite 218, 1499 West Palmetto Park Rd., Boca Raton, FL 33432.

MAG/base3, a database applications-development system. You can design a database to your own specifications for any application. This system includes password protection and entry and edit functions. For CP/M-based systems; floppy disk, \$795. Micro Applications Group, Suite 205, 20201 Sherman Way, Canoga Park, CA 91306.

Micro-WYL, a line-oriented text editor. This program performs all the standard text-editing functions, including moving and copy text within a document, global search and replace, and copying external files. For CP/M-based systems; floppy disk, \$25. Realworld Software Inc., Suite 103, 913 South Fourth St., DeKalb, IL 60115.

PROMutil, a utility for programming, reading, verifying, and editing EPROMs (erasable programmable read-only memories). Designed for use

with the SD Systems' PROM 100 S-100 programmer board, the program can work with 2708, 2716 and 2732 EPROMs. For CP/M-based systems; floppy disk, \$70. Concise Datacom Systems Inc., 1503 Pear Tree Lane, Bensalem, PA 19020.

UAPLink, a telecomputing file-transfer program. Designed specifically for Digital Equipment Corporation's VT18X computer, this program features data compression, file protection, and global transfer commands. For VT18X computers running CP/M; floppy disk, \$250. Unique Automation Products, Suite L, 17922 Sky Park Circle, Irvine, CA 92714.

Heath

Exterminator, an arcade-type game. As the Exterminator, your job is to wipe out the anthropol eggs before they hatch into deadly carnivorous creatures. For one player. For the H89, Z-90, and H8/H19; floppy disk, \$19.50. Evryware, POB 60802, Sunnyvale, CA 94088.

Key-Wiz, a multikeyword database-management program. This program operates as a file of "index cards" and will search a file for a particular keyword. Save up to 300 entries of 60 lines each. For the H89; floppy disk, \$19.95. Interactive Micro Systems, POB 21007, Columbus, OH 43221.

IBM Personal Computer

Friendlyware PC Introductory Set, a set of programs for novices. Includes games, utilities, and business applications. The user's manual explains the workings of the computer. For the IBM Personal Computer; floppy disk, \$49.95. Friendlysoft Inc., 213 Pebblebrook, Arlington, TX 76014.

Highcalc, a highway design and construction utility package. It calculates the cut and

fill amounts required for highway construction. For use by contractors and engineers. For the IBM Personal Computer; floppy disk, \$195. Softov Consultants, Suite R102, 360 Bloor St. E, Toronto, Ontario, M4W 3M3, Canada.

Pairstat, a statistics program used to evaluate and present paired data. Statistical results can include R square, standard deviation, beta, plot of residuals, and mean. For the IBM Personal Computer; floppy disk, \$150. Davell Custom Software, POB 4162, Cleveland, TN 37311.

Supercref, a BASIC language cross-referencing program. This program will display a list of all variables or commands used in a program and the line-number references. It can output information to printer or disk. For the IBM Personal Computer; floppy disk, \$25. The Write Ring, 5050 Garford #160, Long Beach, CA 90815.

Intellivision

Las Vegas Poker & Blackjack, a set of graphics simulation games. You can play four different card games: five or seven card stud, draw poker, or blackjack. The program keeps track of all bets and winnings. For one player. For the Intellivision Master Component; cartridge, \$29.97. Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

Space Spartans, an arcade-type game featuring voice output. The game pits you against an invading alien fleet. You must protect your starbases from attack. The game requires the Intellivoice voice-synthesis module. For the Intellivision Master Component; cartridge, \$45. Mattel Electronics (see address above).

Star Strike, an arcade-type game. You must defend the Earth from attack by an alien

Atari Player-Missile Graphics in BASIC

The Atari computer offers a unique method to manipulate graphics in a BASIC program.

Paul S. Swanson
97 Jackson St.
Cambridge, MA 02140

If you have ever tried to move an object around on the screen using BASIC, you probably made the object look like it was jumping from one point to the next instead of moving along smoothly. One reason for this is that BASIC, which is an interpretive language, has a major drawback—it is too slow. You may have resorted to a crash course in machine language to find a solution to this problem. But machine language, even with the aid of an assembler to form the code from assembly-language statements, takes longer to program and debug than BASIC.

In addition to being slow, BASIC compounds the problem of moving the object. If it is more than one line high, computations must be made to

determine where each line will fall after the move. If the object is 5 dots high and 5 dots wide, you move 25 dots using 5 calculations for determining placement of the object. This does not include the fact that you must first erase the old image, which usually means drawing the shape in

Consider the possibility of superimposing an object on the screen without disturbing the images already there.

the old location using a background color. This doubles the time required from the amount required to draw it—first you “undraw” it in one location, then draw it in the next location.

To complicate matters even further, consider the case where you want to move the object “in front” of some other images that you want on the screen. How do you calculate what colors to put back in the place of the old shape? If you don't put

them back, the object will leave a path through the images on the screen in the color you are using to erase the object when you move it.

The Atari Solution

Consider the possibility of superimposing an object on the screen without disturbing the images already there. The object will not be “on” the screen in memory. Therefore, it will not destroy any part of the images when it moves. Since the Atari computer has two-, four-, and five-color graphics modes, wouldn't it also be nice to use an extra, independent color for this object? That would add a third, fifth, or sixth (depending on the graphics mode) color to the display. As long as we have gone this far, how about having four of these objects, called players, all with independent colors and movements and all with different shapes?

Player-missile graphics on the Atari can do all these things, plus a few other tricks. In addition, it also offers you four 1- or 2-byte-wide “missiles” that you can use.

Editor's Note: This article covers one of the methods for working with player-missile graphics. For details on working with playfield animation, see “The Atari Tutorial, Part 3: Player-Missile Graphics,” *BYTE*, November 1981, page 312. For an excellent overview of Atari BASIC, see “The Atari Tutorial, Part 6: Atari BASIC,” *BYTE*, February 1982, page 91. . . . S. J. W.

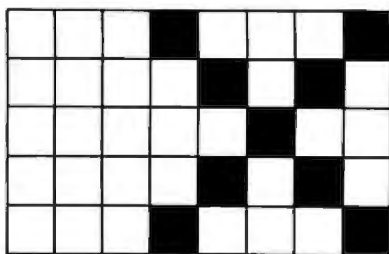


Figure 1: A 5-by-5-dot X-shape can be defined with only 5 bytes of memory.

The players are 8 dots wide. In addition, the dots for the players and the missiles can be single, double, or quadruple width. The width definition can be controlled for each player, but all missiles must have the same width.

Player-missile graphics also solves another problem. The 5-by-5-dot object that was described earlier will require only 5 bytes to describe its shape and the bytes are next to each other. No separate calculations for each line are required to display the object.

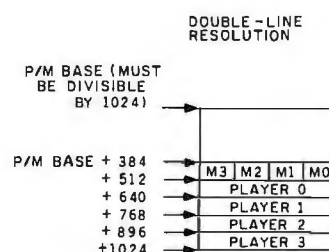
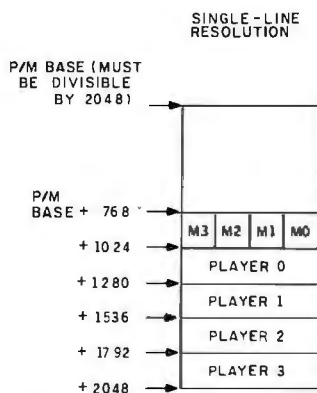


Figure 2: Memory allocation for the player-missile graphics. Definitions for the shape and vertical position of both the players and missiles are kept in this area of memory.

Controlling the players is a fairly simple task. You must describe to the computer the player's position, color, shape, and size. You must also specify what happens if another color is on the screen in the same position as part (or all) of the player. After a few initial steps required to set up the player-missile graphics mode, which is done once for all players and missiles, each of the players is con-

trolled the same way.

Each player occupies a 128-byte strip in memory. A player is one color and is shaped by using one byte in the strip for each horizontal line. Each of the 8 bits will turn on a dot of the player color if it is a 1 and turn off a dot if the bit is a 0. For example, a simple shape such as an X can be defined in a 5-by-5-dot grid (see figure 1), which is what you would do

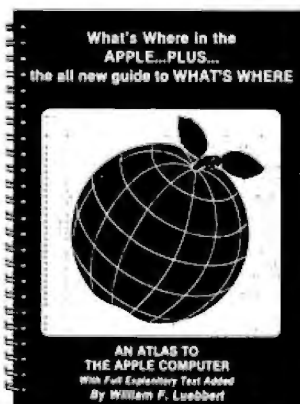
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if you wanted to PLOT the character on the screen.

In figure 1, the values of the 5 bytes required to define it are computed using each horizontal row as 1 byte, taking empty squares as 0 and full squares as 1. The value of the first row converted from binary to decimal is 17, the second row is 10, and the third row is 4. Rows five and six are the same as rows two and one, in that order. The shape may then be defined as a string of characters with

the values 17, 10, 4, 10, and 17. (If the figure is not symmetrical, the first byte defines the top of the figure.) Using this method defines the 25-dot figure with only 5 bytes.

Movement

Player-missile graphics uses two different methods to move the player in horizontal and vertical directions. Horizontal motion is the easier. All you do is use the POKE command to enter the horizontal position (0-255)

into a memory location. Vertical motion is a little harder. You must move the player up and down in the 128-byte strip.

As you may have suspected, there is one catch to using player-missile graphics. The player-missile area must be located in a certain position with respect to a 1K- or 2K-byte boundary. The sample program (see listing 1) uses a double-line resolution player, which requires that the position be aligned with respect to a 1K-byte boundary (see figure 2). A finer method of describing the player shape (single-line resolution) that requires that it be set up starting at a 2K-byte boundary is also available. In that method, the player strips are 256 bytes long.

In the double-line resolution method (i.e., each horizontal line of the player is represented by two television scan lines), the missile area must start 384 bytes after a 1K-byte boundary. The missile area is 128 bytes long. After the missile area, at 512 bytes after the 1K-byte boundary, players 0 through 3 take 128 bytes each so that player 3's area ends on the next 1K-byte boundary.

The problem with this is that BASIC locates the string area in memory depending on the length of the program statements as represented in memory. If you modify a program by adding a statement or two, the strings are started in a higher memory location. This makes it difficult to guarantee that a string will start on the 1K-byte boundary.

One solution is to find the area above the memory that BASIC is using and place the player-missile areas there. Then you can use POKE to move the player vertically. This works, but vertical motion is very slow. If the player is moved with a FOR...NEXT loop, the vertical motion distorts the shape of the player so that it looks like it is swimming up and down the screen. A loop is too slow. FOR...NEXT statements with a POKE in between are not the fastest way to do this.

BASIC can move data around in strings at very high speeds. The POKE command is not too fast because it moves only 1 byte at a

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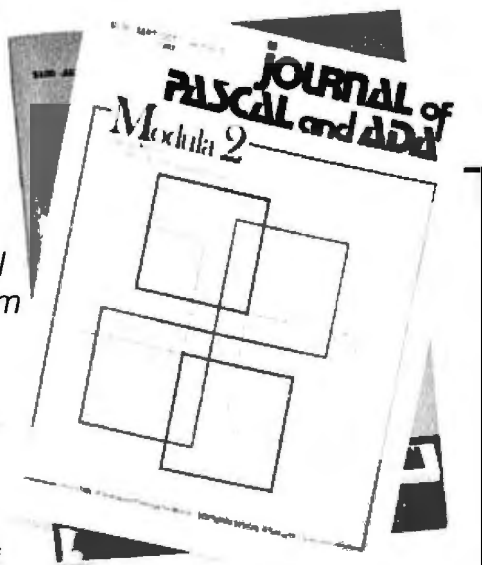
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Listing 1: Sample program using player-missile graphics. The program requires a joystick.

```

9 REM ** FIND START OF STRING SPACE **
10 DIM X$(1)
20 A=ADR(X$)
29 REM ** GET FIRST 1K BOUNDARY ****
30 B=INT((A-512)/1024+1)*1024
39 REM ** FILL UP TO PLAYER 0 AREA ***
40 DIM F$(B-A+511)
49 REM ** P0$ IS PLAYER ZERO AREA ****
50 DIM P0$(128)
58 REM ** S$ IS SHAPE, HM AND VM ARE
59 REM ...USED TO READ JOYSTICK ****
60 DIM S$(12),HM(15),VM(15)
69 REM ** DEFINE PLAYER ZERO SHAPE ***
70 S$="A**A"
79 REM ** READ JOYSTICK VALUES ****
80 FOR I=1 TO 15
90 READ HP,VP
100 HM(I)=HP
110 VM(I)=VP
120 NEXT I
129 REM ** CLEAR PLAYER ZERO AREA ****
130 P0$=CHR$(0)
140 P0$(128)=CHR$(0)
150 P0$(2)=P0$
159 REM ** DRAW SCREEN BACKGROUND ****
160 GRAPHICS 4
170 SETCOLOR 0,0,10
180 COLOR 1
190 PLOT 45,18
200 DRAWTO 45,12
210 DRAWTO 30,12
220 DRAWTO 30,24
230 DRAWTO 55,24
240 DRAWTO 55,6
250 DRAWTO 20,6
260 DRAWTO 20,30
270 DRAWTO 65,30
280 DRAWTO 65,0
290 DRAWTO 20,0
299 REM ** SET PRIORITY = 1 ****
300 POKE 623,1
309 REM ** GIVE ANTIC P/M BASE PAGE **
310 POKE 54279,INT(E/256)
319 REM ** SET TWO-LINE GRAPHICS ****
320 POKE 559,46
329 REM ** ENABLE P/M GRAPHICS ****
330 POKE 53277,3
339 REM ** COLOR = 2, LUM. = 4 ****
340 POKE 704,36
349 REM ** HORIZ. POSITION = 110 ****
350 HP=110
359 REM ** VERT. POSITION = 50 ****

```

Listing 1 continued on page 244

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Listing 1 continued:

```

360 VP=50
369 REM ** SET HORIZONTAL POSITION ***
370 POKE 53248,HP
379 REM ** SET DOUBLE SIZE PLAYER ****
380 POKE 53256,1
389 REM ** SET NO.BYTES IN PLAYER ****
390 LS=LEN(S$)
409 REM ** INIT. COLLISION FLAG *****
410 HITC=0
419 REM ** DISABLE CURSOR *****
420 POKE 752,1
429 REM ** CLEAR COLLISION REGISTER **
430 POKE 53278,0
439 REM ** PUT PLAYER IN AREA *****
440 P0$(VP,VP+LS)=S$
449 REM ** WAIT UNTIL USER IS READY **
450 ? "PRESS TRIGGER TO START"
460 IF STRIG(0)=1 THEN 460
470 ? ">";REM --CLEAR SCREEN
489 REM ** INITIALIZE SCORE COUNTER **
490 COUNT=0
499 REM ** PLAYER MOVE LOOP *****
500 P0$(VP,VP+LS)=S$
510 COUNT=COUNT+0.1
512 IF COUNT=INT(COUNT) THEN SOUND 1,20,12,7
520 HIT=PEEK(53252)
522 SOUND 1,0,0,0
530 S=STICK(0)
540 HP=HP+HM(S)
550 VP=VP+VM(S)
560 POKE 53248,HP
570 POKE 53278,0
575 IF HP<80 THEN 700
580 ? INT(COUNT);""
590 IF HIT=0 THEN HITC=0:GOTO 500
600 IF HITC=1 THEN 500
610 SOUND 0,20,12,7
620 ? "? "YOU HIT THE WALL!!"
630 ? "THAT COSTS YOU 25 POINTS!!";?
635 COUNT=COUNT+25
640 ? INT(COUNT);"";REM MOVE CURSOR UP
650 SOUND 0,0,0,0
660 HITC=1
670 GOTO 500
699 REM ** END OF GAME ROUTINE **
700 POKE 752,0
710 ? ">";REM CLEAR SCREEN
720 ? "YOUR SCORE : ";COUNT
730 ? "PRESS RETURN TO PLAY AGAIN";
740 INPUT X$
750 GOTO 130
999 REM ** DATA FOR HMOVE,VMOVE *****
1000 DATA 0,0,0,0,0,0,0,0,1,1,1,-1,1,0,0,0,
-1,1,-1,-1,-1,0,0,0,0,1,0,-1,0,0

```


time. First, BASIC must read the command and interpret what to do. After all that "overhead," all you get is 1 byte transferred. Using LET statements between strings is a much more efficient method because you have the overhead of reading and interpreting only once. Then the statement can be one that moves as many bytes as you want. It is therefore very much to your advantage to use strings instead of POKE in player-missile graphics.

Sample Game

Listing 1 is included here to help describe how to implement player-missile graphics in BASIC using strings. It is a simple game using a background screen over which player 0 can move. It uses the joystick to get the player out of a simple maze.

Lines 10 through 50 set up and dimension P0\$ for player 0, so that the starting location of the string is 512 bytes above a 1K-byte boundary. Lines 10 and 20 find where the string area starts. Line 30 sets B equal to the value of the 1K-byte boundary that is within 512 bytes of the start of the string space. Player 0's area must begin 511 bytes above that location minus A. That is handled by placing a filler string (line 40) to move the pointer that will locate P0\$ at the right spot. Line 50 dimensions P0\$.

This method will always place P0\$ at 512 bytes above a 1K-byte boundary, no matter how long the program is, until you run out of memory. To use players 1 through 3, you can simply add the strings P1\$, P2\$, and P3\$, each dimensioned to 128, onto the dimension statement (keep them in order).

Now that the string has been set in the correct position, initialization of all the variables and other items can take place. The first part defines the player shape. The player in this game is a flattened X. The design is in figure 3. Two zero bytes are used, one on each end of the player (vertically) so that it will erase the old image when you create the new image (the program allows the player to move only one vertical position at a time). The bytes from top to bottom are 0, 65, 42, 28, 28, 42, 65, and 0. Line 70

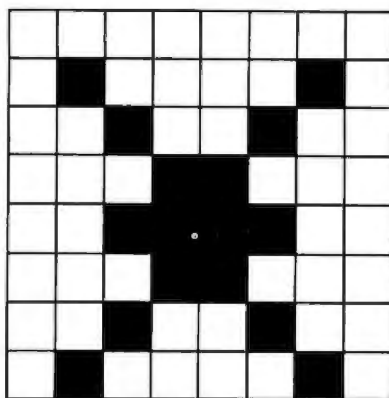


Figure 3: The modified X-shape as used in the program.

defines the player using a control-comma for the zero bytes, capital A for 65, an asterisk for 42, and escape-control-hyphen for 28. The characters to use for most values can be found in Appendix C of the *Atari BASIC Reference Manual*. If you are not that ambitious, you can substitute a FOR. . .NEXT loop. The following loop will work in place of line 70:

```
70 FOR I=1 TO 8
72 READ S
74 S$(I)=CHR$(S)
76 NEXT I
78 DATA 0,65,42,28,28,42,65,0
```

The DATA statement in line 78 will not interfere with the operation of the next FOR. . .NEXT loop because the data for that will begin at line 1000.

The loop starting at line 80 reads values into two arrays that will help decode the joystick movements into +1, 0, or -1 horizontally and vertically. The two arrays defined here will make the reading of the joystick much faster; speed is important in that loop.

The next series of statements, starting at line 130, sets all bytes in P0\$ to 0. The only bits we want set are where the player is to be. All the others must be 0.

Lines 160 through 290 draw the maze the player is to move through. This maze is actually a spiral-like series of lines at right angles, as you will see when you run the program. Any shape that the player can fit through will work.

The next section of the program, starting at line 300, sets up the player-missile area. One part writes to special memory locations, called hardware registers. These are actually data lines to the graphics controller microprocessor, called ANTIC. It controls the screen display and all graphics commands go through it. ANTIC also superimposes the players and missiles over the screen image.

You can't read what is in the hardware registers, but you can read and write to the shadow registers. The shadow registers are memory locations, which in this case are below 1024. The operating system reads the shadow registers and sends their values to the corresponding hardware registers. These values are sent when the screen is blanked-out before the scanner starts to trace the next video frame. Since ANTIC receives these values 60 times per second, the delay is minimal.

Line 300 refers to one of these shadow registers. This sets up the priority of the players and missiles. Using the POKE command to enter a 1 in this location causes the players and missiles to have priority, which makes them look as if they are moving in front of the images on the screen. A value of 8 causes the players and missiles to appear to move behind the screen image.

Line 310 tells ANTIC (directly—no shadow register) where to find the player-missiles. The value put in this location using POKE is the page number of the 1K-byte boundary that is just below the player-missile area. It adds to this location (INT(B/256)) to find your images.

Line 320 tells ANTIC through a shadow register that you want double-line resolution on the players. Other "legal" codes are at this location that will do different things. Be very careful what you put here with POKE.

The color of player 0 is set at line 340. The value is the color number times 16 plus the luminance value. This location, which is a shadow register, controls the color of player 0 and missile 0 (the missiles are the same color as the player of the same number). You can set the colors for

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players 1, 2, and 3 by adding lines to POKE values in registers 705, 706, and 707.

Lines 350 and 360 set the variables that will be used by the program for the horizontal and vertical position values of the player. Line 370 tells ANTIC what the horizontal position of player 0 is to be. Players 1, 2, and 3 are in locations 53249, 53250, and 53251. The horizontal positions for missiles 0 through 3 are at locations 53252 through 53255.

Line 380 sets ANTIC to display the shape at double its horizontal size. Values of 0 and 2 at this location set single size; a value of 3 sets quadruple size. This is read in binary and the last 2 bits are the only ones that are read by ANTIC. Therefore, a value of 4 will be interpreted as a 0, a 5 as a 1, etc. Players 1, 2, and 3 use locations 53257, 53258, and 53259.

LS is set to the length of S\$ in line 390. The variable LS is used in moving the player instead of LEN(S\$) because it is faster.

There is a provision for reading when players are in "conflict" with other players, screen colors, and missiles. Also, another provision detects a conflict between missiles and screen colors. Separate locations can be read to find out if such a conflict has occurred, one of which is used in this program. HITC is used in the program (line 410) to store a flag of 1 if a conflict has taken place and has not been cleared.

A constantly updated display will be in the text window that shows elapsed time. Because the cursor would serve no purpose in it and would make the number harder to read, line 420 shuts it off.

When a conflict has taken place, the corresponding location is set to 1. It is not reset when the player or missile is moved out of conflict. Location 53278 resets all the conflict indicators (Atari uses the term "collision" instead of conflict). ANTIC sets the registers again a few milliseconds later if there is still a conflict.

Line 440 places the player on the screen by putting the shape into the player area. This string statement can now be used because the player-area string is in the correct position. This

Line Number	Description
500	Places the player image into the player area at vertical location VP. The first time through this has already been done, but the loop must always end by repositioning the player. It branches back to 500 to do this.
510	Increments the counter by 0.1. This is incremented each time the loop is run and will have the effect of timing the game in arbitrary units.
512	At each tenth increment, when COUNT is an integer, the computer will generate a click in the television speaker. The person playing can keep track of time without referring to a number that he or she hasn't got time to look at.
520	Reads the collision register for player-to-playfield position.
522	Shuts off the sound started in line 512.
530	Reads the value of joystick 0.
540-550	Updates the horizontal and vertical positions using the two arrays to interpret the joystick value returned.
560	Tells ANTIC what the new horizontal position is.
570	Clears the collision registers. ANTIC has plenty of time between this statement and the next read of the collision register (line 520) to update them several times.
575	Detects the end of the game.
580	Displays the current time value.
590	Clears the HITC flag and returns to the beginning of the loop if there is no conflict.
600	Begins the routine that is used when the player hits the side of the maze. If the HITC flag is 1, the hit was already counted. Therefore, this statement goes back to the beginning.
610	Begins sound effect of hitting the wall.
620-640	Displays message that the player hit the wall, adds a penalty to the timer, and redisplay the timer.
650	Stops sound effect started at line 610.
660	Sets HITC flag to indicate hit has been counted.
670	Goes back to start next loop.
700	Line 575 branches here if the player is moved beyond the left edge of the maze, which is assumed to end the game. Since a message will be printed followed by an INPUT statement, line 700 turns the cursor back on.
710-740	Displays the full score (previous displays were the integer value) and waits for the RETURN key.
750	Goes back for another game.

Table 1: Description of the main section of the sample program. Lines previous to line 500 initialized the player-missile graphics.

statement replaces, in this example, 8 POKE statements, which would take much longer to execute. The statement in line 440, placed in a FOR...NEXT loop that goes from 1 to 1000, takes 15 seconds. Using a corresponding POKE statement in a FOR...NEXT loop to place 8 bytes would have taken 2 minutes, 38 seconds in the same FOR...NEXT loop. Allowing 8.5 seconds for the FOR...NEXT loop, a simple division shows that line 440 is more than 17 times faster than using a POKE statement.

Lines 450 through 490 first wait for the person playing the game to press the trigger button and then set the scoring variable COUNT to 0. Note that the clear screen statements clear only the text window.

Now that everything is initialized, we can use player-missile graphics in

the game. Because of the concern for speed of execution, REM statements were minimized in the next portion of the program. The function of these statements is described in table 1.

The program cannot check to see if you go "through" a wall when you hit it—it merely fines you 25 points.

Error Checking

This game does have a few faults (meaning that it is not idiot-proof). It has no checks if the player is moved off the screen and out of the player area. This will result in error messages. The program cannot check to see if you go "through" a wall

when you hit it. It will fine you 25 points when you hit the wall, but has no way of determining if you got out of the conflict on the correct side of the wall. Lastly, it tests for the "game over" condition by checking the horizontal position of the player. If it is low enough, it is assumed that the player left the maze at the correct point.

The above faults can be eliminated by using extra statements in the loop (lines 500 through 670) to test the conditions. Testing if the player went through a wall instead of going back from where it came may be a little difficult, but the range check is simple—just test that HP is between 0 and 255 and that VP is between 1 and 128-LS. You can refine the finish test by also testing that the vertical position is less than 18 (like the screen vertical positions, the player-missile vertical positions go from the top = 1 to the bottom = 128).

The collision-detection register will not be 1 for a collision if you do not use, in this case, the COLOR 1 statement for the maze. The detection is bit-coded so that it may also tell you what you hit. Because the low-order 4 bits are used, the value never exceeds 15. The positions of the bits that are on correspond to the SETCOLOR numbers of the color bit. The register indicates 1 for color 0, 2 for color 1, 4 for color 2, and 8 for color 3. The BASIC COLOR statement COLOR 1 actually specifies the color from color register 0, which is why it returns a value of 1. If the maze were drawn with a COLOR 2 statement preceding it, the collision detection would return a 2 when there is a conflict. The program would have to be altered to compensate for this.

Note one very important item in the use of strings for the player-missile graphics. The player positions will move when you go from deferred mode while the program is running to immediate mode. This is caused by BASIC moving things around when the program is not running. Any position tests you do on the player must be done during the time the program is running. Stopping the program with the Break key, then using CONT to resume, will also alter the

position. The program should be RUN from the beginning to get an accurate position.

You may also have noticed that, when you go to the second or subsequent game by pressing Return at the end of one game, the player turns into a jittering stripe running vertically the full length of the screen. This happens when a player is on the screen during a GRAPHICS statement execution. This will destroy the position of the player, causing the line of garbage. In this program, the player-missile graphics is reinitialized completely, which puts the player back where it belongs. When writing the initialization part of programs that use player-missile graphics, remember to execute the GRAPHICS statement before you set up the player-missile graphics. The stripe can be eliminated in this program by adding the line

745 POKE 53248,0

This moves the player off the left side of the screen. The vertical stripe still

exists, but it occurs in the part of the video cycle where the scanner is turned off to go from the end of one line to the beginning of the next line.

You can also move the player faster by making it increment twice in each loop. The fastest way to do this is to first add zero bytes at the beginning and ending of S\$ so that it starts and ends with two zeros instead of one. Second, alter lines 540 and 550 to add HM(S)*2 and VM(S)*2 instead of HM(S) and VM(S). The player will not move quite as smoothly as before, but will still be vastly smoother than if you plotted it directly on the screen.

Conclusion

This is only a brief introduction and one example of player-missile graphics. Atari can supply you with manuals that describe them in more detail. You can combine the information from Atari manuals with this method to create some very impressive graphics. The method of locating boundaries for setting the start of ar-

rays can also be used to place alternate character sets for character graphics, screen displays, and display lists.

This method of moving the players in BASIC opens up more uses for BASIC in graphics, but it is still a very slow way to execute graphics routines if they require smooth motions around the screen. It can be used only if the computations and testing required in the loop are small in number. Remember that BASIC is running in milliseconds, not microseconds like machine language; it is 1000 times slower at its best.

The incredible graphics power of your Atari computer can, as shown in this modest example, compensate for the speed difference somewhat and perform some things that are not possible in BASIC on any other microcomputer I have used. If you take advantage of the right things, for example, the speed of string-to-string transfers in LET statements, you will be amazed at what your Atari can do—even in BASIC. ■

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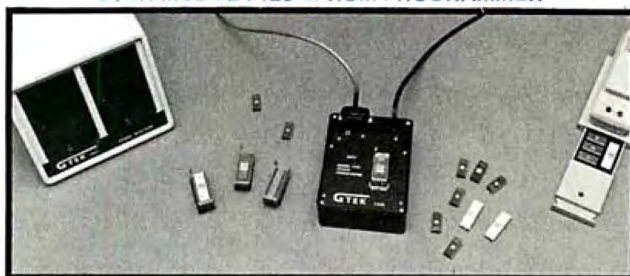
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The House Subcommittee on Courts, Civil Liberties, and Administration of Justice is considering legislation for software protection. If passed, the new law will amend the federal Copyright Act as to the definition of computer software and will emphasize that reliance on copyright protection in no way precludes any state trade-secret protection. Also, the use of a copyright mark on unpublished software will not constitute publication. The user will have to deposit the computer software with the Copyright Office in the same manner as printed material.

Computer Games: It is estimated that Atari has shipped 6 million video-game units so far and grossed over a billion dollars from sales (that doesn't include game cartridges). Atari has about 75 percent of the video-games market, while Mattel has about 15 percent;

the remainder is shared by Coleco, Astroarcade, and Emerson Radio.

After several years of skyrocketing growth, sales of video-game units are expected to grow at a much more moderate rate. This is because personal computers are now selling in the same price range and offer other benefits besides the ability to play games. Thus, game manufacturers such as Atari and Mattel have begun to slash prices and offer rebates. Atari is expected to introduce a new game unit with powerful graphics at a price well under \$200, while previous plans had called for a price over \$250.

Similarly, Commodore, which had previously announced a target price of \$180 for its new Max game unit, is expected to drop the price to \$150 when the unit finally appears on dealers' shelves. Game-cartridge suppliers such as Parker Bros., Imagic, and Activision, which previously supplied cartridges only for game units, are expected to start supplying their game cartridges for personal computers as well.

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SuperPILOT, a new implementation of the PILOT language. This system features improved graphics control, flexibility to use video tape and videodisc players, and turtle graphics. For the Apple II; floppy disk, \$200. Apple Computer Inc. (see address above).

Type Attack, an educational game. The objective of this game is to learn to touch-type by seeing characters on the screen and pressing the corresponding keys on the keyboard. For the Apple II; floppy disk, \$39.95. Sirius Software Inc. (see address above).

Warp Destroyer, an arcade-type game. After traveling through hyperspace, you will be faced with mines, fighters, and probes. You must shoot these and go on to the Zalbian bases before you can return. For the Apple II and II Plus; floppy disk, \$29.95. Piccadilly Software Inc., 89 Summit Ave., Summit, NJ 07901.

Wayout, an arcade-type game. Working with the cardboard compass and glasses provided in the package, find your way out of the maze by using the mapmaker and watching the fireflies. For the Apple II and II Plus; floppy disk, \$39.95. Sirius Software Inc. (see address above).

Word Weaver III, a word-processing system. This system uses all standard word-processing features, including 80-column display, menu-driven functions, and global

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You're the Doctor, a simulation-type game. You become a doctor examining patients, trying to diagnose and prescribe treatment. This simulation game includes high-resolution graphics and sound. For the Apple II; floppy disk, \$17.95. Simulations Software, POB 608, Station U, Toronto, Ontario, M8Z 5Y9, Canada.

Zork III: The Dungeon Master, an adventure-type game. The final episode in the Zork trilogy takes you to a confrontation with the Dungeon Master himself. This game responds to plain English commands. For the Apple II; floppy disk, \$39.95. Infocom Inc. (see address above).

Atari

Claim Jumper, a two-player arcade-type game. The object is to get all the gold you can, trade it for money, and get your money to the bank. Beware of claim jumpers, snakes, and killer tumbleweeds. For the Atari 400/800; floppy disk, \$34.95. Synapse Software, Suite I, 5327 Jacuzzi St., Richmond, CA 94804.

Escape from Vulcan's Isle, a graphics adventure-type game. You're shipwrecked on a desert island. You must explore and discover a way off the island before the volcano erupts. On your way, you collect magic treasures—but avoid the monsters. For the Atari 400/800; floppy disk, \$29.95. Epyx/Automated Simulations, 1043 Kiel Court, Sunnyvale, CA 94086.

King Arthur's Heir, a graphics adventure-type game. You must prove yourself worthy to hold the crown of Camelot. Your quest is to find the Scroll of Truth, hidden by Merlin. For the Atari 400/800; floppy disk, \$29.95.

Epyx/Automated Simulations (see address above).

Marathon, an educational game. The object in this math quiz is to get your runner across the screen first by correctly answering the problems. The game has four levels of play and is designed for ages 8 to 16. For the Atari 400/800; floppy disk, \$19.95. Educational Software Inc., 4565 Cherryvale Ave., Soquel, CA 95073.

Protector II, an arcade-type game. You must rescue 18 people from alien attack and deposit them safely on the other side of a volcano. This game features improved play and action. For the Atari 400/800; floppy disk, \$34.95. Synapse Software (see address above).

Space Games, a games package that includes adventure- and arcade-type games. You must find your way out of the maze and shoot the aliens to save your home in outer space. For the Atari 400/800; floppy disk, \$24.95. Educational Software Inc. (see address above).

Valley of the Kings, a graphics adventure-type game. You are in a mountainous region of Egypt and you must locate objects and passages to survive the three levels of the game. For the Atari 400/800; floppy disk, \$29.95. Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

CP/M

Cardbox, a simple database-management system. Entries to this database are treated as electronic index cards. You can select input, report, and display formats and retrieve data using keywords. For CP/M-based systems; floppy disk, \$245. Caxton Software Publishing Co., 10-14 Bedford St., Covent Garden, London, WC2E 9HE, England.

MCDisplay, a terminal interface program. With this program, complete terminal

displays can be defined in advance, which simplifies text and data entries and enhances prompts and messages. Display layout sheets are included. For CP/M-based systems; floppy disk, \$175. Master-computing Inc., POB 17442, Greenville, SC 29606.

Medent, an accounts-receivable system designed for medical and dental offices. This system features record-access by number or name and automatic statements with aging. For CP/M-based systems; floppy disk, \$1900. Community Computer Service Inc., POB E, Auburn, NY 13021.

Members Program, a mailing-list management program. Designed for maintaining member lists of organizations, this program can create, modify, and output alphabetically sorted lists or mailing labels. For CP/M-based systems; floppy disk, \$75. Datamasters, Unit 10, 12700 Northeast 124th St., Kirkland, WA 98033.

Microsoft Multiplan, an electronic spreadsheet system that features an on-line reference guide, alphanumeric sorting, up to eight display windows, use of Visicalc files, and variable-width columns. For CP/M-based systems; floppy disk, \$275. Microsoft Corp., C-97200, 10700 Northrup Way, Bellevue, WA 98004.

Oubliette, an adventure-type game similar to Dungeons and Dragons. You must seek the gold hidden in the dungeon beneath the castle. You can define your player's characteristics. For CP/M-based systems; floppy disk, \$39.95. Computer Management Service, 501 Jackson, Charleston, IL 61920.

SCP/80, a set of utility programs to enhance CP/M. These programs facilitate data movement or modification and display status of files, memory, and devices. For CP/M-based systems;

mathematical problems. Designed for professionals or students, this program can, for example, handle simultaneous equations in algebraic form. For the Apple II; floppy disk, \$250. PCD Systems Inc., 163 Main St., POB 143, Penn Yan, NY 14527.

Instant Zoo, a set of five programs for children aged 7 to 10. This package has fast-moving games to help develop pattern-recognition and word skills. For the Apple II; floppy disk, \$50. Apple Computer Inc. (see address above).

League Registration, a filing system for sports league information. This system lets you organize, manage, and retrieve league and player information. A program disk can hold information on up to 500 players. For the Apple II Plus; floppy disk, \$150. Market Computing, 201 15th Ave. SW, Puyallup, WA 98371.

League Scheduling, a program that creates a round-robin schedule for one or more athletic leagues. It prepares a game schedule taking into account teams, times, days of the week, and holidays or rainouts. For the Apple II Plus; floppy disk, \$100. Market Computing (see address above).

League Standings, a program that registers game results and computes league and team standings for one or more leagues. This program records win/loss statistics, displays statistics on screen, and lets you edit statistics. For the Apple II Plus; floppy disk, \$100. Market Computing (see address above).

Long-Term Reservations, a time-scheduling program that handles reservations for sports facilities where long lead-times and variable-length time periods are desired. Completed schedules can be sent to a printer. For

the Apple II Plus; floppy disk, \$100. Market Computing (see address above).

Mix and Match, a set of four educational games for children. This package includes a muppet match game, an animal word game, a puzzle, and a word game. An editor is provided for the word game. For the Apple II; floppy disk, \$50. Apple Computer Inc. (see address above).

Monster Mash, an arcade-type game. Your job is to prevent the monsters from leaving the graveyard and attacking the people in the city. All you have are your reflexes and the Monster Mash. For the Apple II and Apple III; floppy disk, \$29.95. The Software Farm, 3901 South Elkhart, Aurora, CO 80014.

PDQ 1.0, a database-management program featuring user-friendly prompts, simple commands, and fast retrieval. Its files can hold up to 28,000 characters. You can have as many as eight files on two drives. For the Apple II; floppy disk, \$59.95. Howard W. Sams & Co. Inc. (see address above).

The Programmable Cube, a program for solving the Rubik's Cube puzzle. Serving as an exercise in programming instruction, this package allows you to develop a cube-solving program. Video displays generated by this program are suitable for black-and-white or color monitors. For the Apple II; floppy disk, \$34.95. Metacomet Software, POB 31337, Hartford, CT 06103.

Quick-Search Librarian, a database-management program that cross-references literature citations. Technical references or journal articles can be cross-referenced with up to 12 keywords. One thousand articles or references can be stored on a single disk. For the Apple II

Plus; floppy disk, \$75. Interactive Microware Inc., POB 771, State College, PA 16801.

Rapid Reader, an educational program. This program helps to increase reading speed by progressively training you to rapidly recognize words and whole sentences. For the Apple II; floppy disk, \$39.95. Silicon Valley Systems, Suite 4, 1625 El Camino Real, Belmont, CA 94002.

Short-Term Reservations, a time-scheduling program that can make weekly lists of reservations for sports facilities and print out the schedule showing reserved times, facilities, and contact persons. For the Apple II Plus; floppy disk, \$100. Market Computing (see address above).

Spotlight, a set of four games for children aged 9 to 13. The games cover such advanced ideas as how light is reflected and elementary logic. For the Apple II; floppy disk, \$50. Apple Computer Inc. (see address above).

Swim Meet, a management program for scheduling swimming meets. This program registers contestants, records times, assigns lanes, and prints a list of final standings. For the Apple II Plus; floppy disk, \$125. Market Computing (see address above).

Tennis Draw, a tennis tournament-management program. This program registers and seeds players and teams for matches. It follows the U. S. Tennis Association rules. For the Apple II Plus; floppy disk, \$60. Market Computing (see address above).

Transylvania, an adventure-type game. The object of this game is to rescue a princess from the evil vampire. You must search a forest and a castle deep within Transylvania—avoid the werewolf.

For the Apple II; floppy disk, \$34.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

Visicalc Advanced Version, an electronic spreadsheet program. This version allows you to protect memory cell contents and hide sensitive information. It includes on-screen help displays. For the Apple III; floppy disk, \$400. Visicorp (see address above).

Atari

Alien Garden, an arcade-type game. You're an alien critter in a garden of crystal flowers. You must eat, bump, or sting as many flowers as you can before they destroy you. For the Atari 400/800; cartridge, \$39.95. Epyx/Automated Simulations Inc., 1043 Kiel Court, Sunnyvale, CA 94086.

Armor Assault, a simulation game. You're the commander of NATO's armored forces. You must try to stop the enemy's armored columns from rolling across the North German plain. For one or two players. For the Atari 400/800; floppy disk, \$39.95. Epyx/Automated Simulations Inc. (see address above).

Bandits, an arcade-type game. You must guard the supplies on a lunar supply depot from the thieving aliens. You are armed with a mobile laser gun and protected by a limited shield. For the Atari 800; floppy disk, \$34.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

BASIC Routines, a set of program routines and instructions to help you learn how to program an Atari computer. This package features common subroutines for player graphics and disk utilities. For the Atari 400/800; floppy disk, \$24.95. Adventure International, POB 3435, Longwood, FL 32750.

Disk Workshop, a set of disk-utility programs that allows you to edit disks, copy disks rapidly, send a disk directory to a printer, and use machine-language strings in BASIC programs. For the Atari 400/800; floppy disk, \$39.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

Diskey, a disk-utility program. With this program, you can examine and modify any sector on a disk, list unreadable sectors, send data in a sector to a printer, and copy a disk. Only one disk drive is required. For the Atari 400/800; floppy disk, \$49.95. Adventure International (see address above).

Gorf, a set of four arcade-type games: Astro Battles, Laser Attack, Space Warp, and Flag Ship. In all the games, you must destroy the attacking aliens to increase your score. For the Atari 400/800; floppy disk, \$39.95. Roklan Software, 10600 West Higgin Rd., Rosemont, IL 60018.

Labyrinths, a role-playing game. From a list of characters, you choose an identity to explore the labyrinth, find treasures, and fight monsters. For the Atari 400/800; floppy disk or cassette, \$28.95 and \$24.95, respectively. Progressive Computer Applications, POB 46, Burtonsville, MD 20866.

Paint, an educational program for children. This program lets your child draw color pictures on the screen, enlarge the picture, save it, and use different "brush" strokes and textures. For the Atari 400/800; floppy disk, \$39.95. Reston Publishing Co. Inc., 11480 Sunset Hills Rd., Reston, VA 22090.

Programmer's Workshop, a set of six utility programs. This package includes a disk-to-cassette transfer program, a compare utility for BASIC programs, and a cassette data-rate increase utility. For

the Atari 400/800; floppy disk, \$39.95. Synergistic Software (see address above).

Sneakers, an arcade-type game. Shoot the aliens before they destroy your ships. This game features five levels of skill and up to nine attacks per level. Points are scored for each alien shot. For the Atari 800; floppy disk, \$34.95. Sirius Software Inc. (see address above).

Wizard of Wor, an arcade-type game. As you progress through a series of mazes, you must destroy the wizard and the various creatures that aid him to score points and win the game. For the Atari 400/800; floppy disk, \$39.95. Roklan Software (see address above).

CP/M

Accounts Receivable, an accounts-receivable package. This menu-driven package features on-demand reports for customer lists and master, aged analysis, and control reports. For CP/M-based systems; floppy disk, \$1095. Cougar Mountain Software, 10 South Latah, POB 6886, Boise, ID 83707.

Data Champ, a database-management program. Designed for the first-time user, this package allows you to create a customized database. The manual includes a complete training program. For CP/M-based systems; floppy disk, \$395. Innovative Micro Systems, 12506 East 21st St., Tulsa, OK 74219.

Disk Fix, a disk editor and file-recovery utility program. You can examine, copy, and edit any disk sector. It lets you recover disk files, reconstruct damaged sectors, and use both hexadecimal and ASCII numbers. For CP/M-based systems; floppy disk, \$150. The Software Store, 706 Chippewa Square, Marquette, MI 49855.

The Disk Inspector, a disk-utility program that lets you examine any sector on any

disk. Sectors from two different drives can be simultaneously displayed, copied, or modified. For CP/M-based systems; floppy disk, \$29.95. Realworld Software Inc., Suite 103, 913 South Fourth St., DeKalb, IL 60115.

Fancy Font System, a text-processing and print-formatting package designed for use with the Epson MX-80 printer. You can use a wide variety of letter fonts or create your own special font. For CP/M-based systems; floppy disk, \$180. Softcraft, Suite 1641, 8726 South Sepulveda Blvd., Los Angeles, CA 90045.

Menu-master, a system that allows you to develop custom menus for applications programs. The menus can provide user prompts, help and error messages, and error trapping. For CP/M-based systems; floppy disk, \$195. Borland International, 69 Upper Georges St., Dun Laoghaire, Dublin, Republic of Ireland.

S-BASIC, a structured BASIC translator and compiler. This version of BASIC features the ability to reference subroutines by name, indenting to display program structure, and other such functions. Program line numbers are not required. For HDOS- and CP/M-based systems; 5¼-inch floppy disk, \$49.95. Sunflower Software, 13915 Midland Dr., Shawnee, KS 66216.

IBM Personal Computer

Aqua Run, an arcade-type game. You are a diver seeking treasure in an undersea maze. You must protect yourself from the undersea creatures by avoiding or spearing them. For the IBM Personal Computer; floppy disk, \$39.95. Soft Spot Micro Systems Inc., POB 415, North Canton, CT 06059.

Data Champ, a database-management program (see description under CP/M). For the IBM Personal Com-

puter; floppy disk, \$395. Innovative Micro Systems, 12506 East 21st St., Tulsa, OK 74219.

Executive Suite, a simulation game. In this game, you're an executive moving up the corporate ladder. You move through job interviews, middle management, and on into the executive suite. For the IBM Personal Computer; floppy disk, \$39.95. Armonk Corp., Suite 955, 610 Newport Center Dr., Newport Beach, CA 92660.

FORTH/level 2, an implementation of the FORTH language. This package features a multitasking real-time operating system with online documentation and support for the 8087 mathematics processor chip. For the IBM Personal Computer; floppy disk, \$300. FORTH Inc., 2309 Pacific Coast Highway, Hermosa Beach, CA 90254.

The Graphics Generator, a graphics generation program to create bar graphs, pie charts, and line or function graphs from mathematical data. You can superimpose graphs, send graphs to a printer, or save them on disk. For the IBM Personal Computer; floppy disk, \$195. Robert J. Brady Co., Bowie, MD 20715.

Graphmagic, a graphics generation program. You can draw visual representations of mathematical data in the form of bar and line graphs, pie charts, and scattergrams. For the IBM Personal Computer; floppy disk, \$89.95. International Software Marketing Ltd., Suite 421, 120 East Washington St., Syracuse, NY 13202.

Helpware, an interface program to IBM PC-DOS. This program simplifies using PC-DOS by providing a menu of file-manipulation commands. Files can be displayed, edited, and renamed with a single command. For the IBM Personal Computer; floppy disk, \$195. Soft-

What's New?



Full-Stroke Keyboard for Atari

The B Key 400, a full-stroke keyboard, provides an alternative to the Atari 400's membrane keyboard. Manufactured by Inhome Software, the B Key 400 is easy to install and has all the features of a full-stroke

keyboard. It's available for \$119.95 from Inhome Software Inc., 2485 Dunwin Dr., Mississauga, Ontario L5L 1T1, Canada, (416) 828-0775.

Circle 550 on inquiry card.

Large Keyboards for Disabled

Cacti Computer Services has designed an 11- by 21-inch pressure-sensitive keyboard system for individuals with limited hand or finger control. This system consists of a keyboard with widely spaced contacts, a driver routine, an interface to plug into the computer, connecting cables, and a plastic mask. Once the driver routine has been loaded, the computer's keyboard combines with the large keyboard to run commercially available

software without modifications.

Several keyboard layouts are offered, and custom arrangements can be made at no additional charge. The system is presently marketed for use with Apple and Commodore PET/CBM computers. It costs \$525. For full details, contact Cacti Computer Services, 130 9th St. SW, Portage la Prairie, Manitoba, R1N 2N4, Canada.

Circle 551 on inquiry card.

Expansion Slots for Color Computer

Up to four separate peripherals can be simultaneously connected to Radio Shack's TRS-80 Color Computer with Maple Leaf Systems' Multiport, a multiple-slot expansion unit. Each peripheral is on line and accessible to a program by means of a POKE command. With Multiport, the Color Computer is able to switch between peripherals under software control, which allows a single program access to any or all peripherals at any time. Multiport is described as a powerful hardware circuit that connects directly to all models of the Color Computer.

Multiport comes assembled and tested for \$99.50, and full instructions are included. It's available from Maple Leaf Systems, POB 2190, Station C, Downsview, Ontario M2N 2S9, Canada.

Circle 552 on inquiry card.

Interfaces in Computing

Interfaces in Computing is an international journal for system designers, electronic engineers, technicians, and production managers concerned with computing technology. Topics addressed in this quarterly range from low-speed communications between microprocessors to high-performance buses linking mainframes. Hardware and software inter-

facing are given equal priority.

Annual subscriptions to Interfaces in Computing cost 160 Swiss francs (approximately \$89), including postage. Further details are available from Elsevier Sequoia S. A., POB 851, CH-1001 Lausanne 1, Switzerland; tel: (021) 20 73 81; Telex: 26 620 ELSACH.

Circle 553 on inquiry card.

Microdoctor Diagnoses Computers

Dataman Designs' Microdoctor is an intelligent device to help engineers diagnose faults in computers and computer-controlled products. Microdoctor's built-in printer produces hard-copy printouts of preprogrammed tests on chips in addressing space. This device is capable of testing ROMs (read-only memories), RAMs (random-access read/write memories), and I/O and data lines. It can also be used for memory-mapping unknown systems and writing to or reading from any device in address or I/O space. Memory contents are printed out in hexadecimal or ASCII codes.

Microdoctor, a Z80-based product, comes with a Z80 disassembler that can be used to print out disassembled listings of the ROM in any Z80 system. Disassemblers for other microprocessors are available. The Microdoctor

What's New?

Atari/CP/M Interface

USS Enterprises' Critical Connection provides the means to connect an Atari 400 or 800 to a CP/M system so that the Atari can use the CP/M system's printer, disk drives, and keyboard. This system is made up of hardware to connect an RS-232C port on a CP/M system to an Atari disk/printer port, 50 feet of cable, and an 8-inch single-density disk with software that makes the CP/M system's drives, printer, and keyboard replace the Atari's.

The Critical Connection costs \$175. The company requests that you provide the name of the CP/M system to be connected to the Atari. For a brochure describing the Critical Connection and further purchasing information, contact USS Enterprises, 6708 Landerwood, San Jose, CA 95120, (408) 997-0264. Circle 559 on inquiry card.

Floor Stand for Joysticks

The Grand Stand Company's joystick floor stand is designed for optimum positioning, comfort, and control. The company claims that it is an aid in eliminating wrist and elbow fatigue and improves finger dexterity. The stand is made from solid wood with a walnut finish and streamlined appearance. It costs \$34.95. Order from the Grand Stand Co., 4231 Bluebell Ave., Studio City, CA 91604. Circle 560 on inquiry card.

Interactive Training Programs for Professionals

American Training International (ATI) produces interactive training programs for popular software packages. These programs are targeted for professional users and are designed for CP/M systems and the IBM Personal Computer. ATI's menu-driven software provides hands-on practice, and a course can be completed in an average time of less than 45 minutes. Each course contains a general introduction and periodic refreshers.

ATI complements the training disks with a user's handbook that serves as a referenced hard-copy version of the information covered. Current titles available include PlanPower for Visicalc, D. B. Power for dBASE II, ATI-Power for IBM PC-DOS, and ATI-Power for CP/M. Each course costs \$75. For full details, contact ATI Inc., Suite 300, 3800 Highland Ave., Manhattan Beach, CA 90266, (213) 546-4725. Circle 561 on inquiry card.

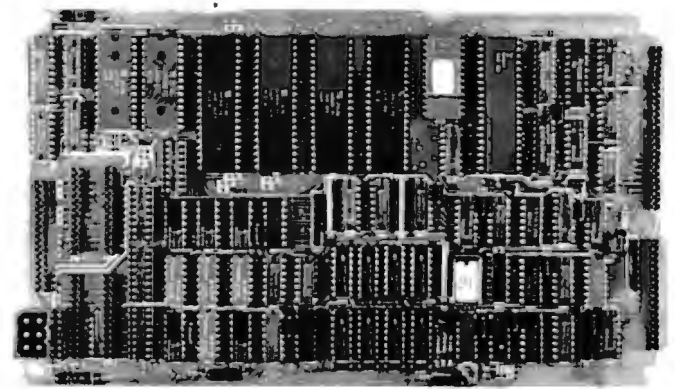
Diagnostic Service for Immediate Updates, Solutions

Tele-Maintenance, a communications and diagnostic service from Rotating Logic Systems, provides immediate hard-disk analyses and software updates. According to the company, electronic analyses over toll-free telephone lines will ensure

that correct service solutions are conveyed to the user's display screen or printer. Routing software updates and service inquiries to factory technicians will give customers on-the-spot service and

corrections. Full particulars on the Tele-Maintenance service will be supplied by Rotating Logic Systems, Highland and White St., Greensburg, PA 15601, (412) 832-0140. Circle 562 on inquiry card.

SYSTEMS

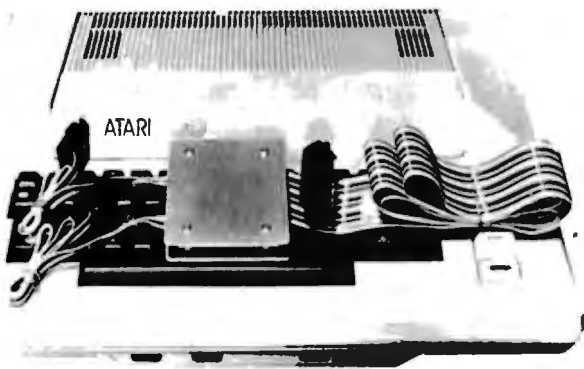


Compact Z80 Board

Davidge Corporation's DSB-4/6 single-board computer measures 10 by 5 $\frac{3}{4}$ by $\frac{3}{4}$ inches—small enough to fit inside a 5 $\frac{1}{4}$ -inch floppy-disk enclosure. The DSB-4/6 comes with a disk controller that automatically interfaces with both single- or double-density 5 $\frac{1}{4}$ - and 8-inch floppy-disk drives simultaneously, a Centronics-type parallel port, a parallel hard-disk port that provides 8-bit bidirectional I/O and A0 and A1 address lines, a 2K-byte boot EPROM (erasable programmable read-only memory), and 64K bytes of RAM (random-access read/write memory). The

DSB-4/6 can be configured for two or four RS-232C serial ports of which three can be used for standard peripherals; the fourth port is available for a modem. The company offers a choice of the 4-MHz Z80A or the 6-MHz Z80B processor.

In single units, the price for the DSB-4/6 ranges between \$695 and \$995, depending on processor and number of I/O ports desired. Quantity discounts are available. For complete details, contact Davidge Corp., Suite X, 1951 Colony St., Mountain View, CA 94043. Circle 563 on inquiry card.



Atari Printer Interface

Looking Glass Micro-products' Interface No.1 allows any printer with a Centronics-compatible parallel interface to be connected to an Atari 400/800 via controller jacks J3 and J4. The interface comes with a printer-handler that replaces the one resident in the Atari and occupies less than 128 bytes of user program area. The printer-handler is compatible with Atari cartridges and programs and

comes on either cassette or disk.

Complete documentation, installation instructions, and program listings are supplied with Interface No.1. It costs \$85, which includes a 15-day money-back guarantee. Dealer inquiries are invited. Full details are available from Looking Glass Microproducts, POB 5084, Loveland, CO 80537.

Circle 567 on inquiry card.

Random-Access Printing

Interactive Structures, manufacturer of the Pkaso ID12 Color Printer Interface, has introduced the IS Pipeline print buffer. Featuring random-access printing, Pipeline lets you select sentences, paragraphs, graphs, or pictures from different programs or computers so that you can compose and print a finished document. Pipeline is useful for inserting graphs into reports, placing addresses on form let-

ters, and compiling letters out of component paragraphs. Standard operating functions include conventional FIFO (first-in, first-out) operation, data compression for space saving, the ability to bypass buffer operations for straight-through printing, a simple erase feature to clear the buffer, and automatic duplication. The Pipeline's memory can be expanded from 8K bytes to 128K bytes, and the

system is compatible with any Centronics-type parallel computer-printer connection.

Pipeline comes with a plug-in power supply, cabling, and manual. It's guaranteed for one year and ranges in price from \$195 to \$405, depending upon buffer size. For further details, contact Interactive Structures Inc., 146 Montgomery Ave., Bala Cynwyd, PA 19004, (215) 667-1713.

Circle 568 on inquiry card.

Pac RAT Stores Up to 8 Megabytes

Damco's Pac RAT (random-access tape) gives you from 5 to 8 megabytes of on-line random-access storage (unformatted) in a package the same size and shape of a standard 5¼-inch floppy-disk drive. Each of Pac Rat's two magnetic tape cartridges has 88 tracks of 60 or 95 sectors (256-byte sectors) per track. A single read or write accesses each cartridge. Pac Rat's power requirements and controller interface are floppy-disk standard so that it can plug into existing systems. In small quantities, it costs less than \$480. Contact Damco, 2210 18th Ave., Rock Island, IL 61201, (309) 793-0655.

Circle 569 on inquiry card.

8086 Upgrade for Heath/Zeniths

Technical Micro Systems' H-1000 is an 8086 upgrade that replaces the

2-MHz Z80 board in Heath/Zenith H-89/Z89 computers. This board retains all the Z80 board's features while providing a 16-bit 8086 processor, two additional I/O slots, 128K bytes of RAM (random-access read/write memory) that can be expanded to 1 megabyte, a dual-speed software-controlled clock for the Z80, and the ability to run the MS-DOS or CP/M-86 operating systems. It's completely compatible with existing Heath hardware and software. When in its 8086 mode, the H-1000 is software-compatible with Z-100 systems and the IBM Personal Computer under MS-DOS or CP/M-86.

In single units, the H-1000 costs \$1495. Full details are available from Technical Micro Systems Inc., Department H, 366 Cloverdale, Ann Arbor, MI 48105, (313) 994-0784.

Circle 570 on inquiry card.

Modem Operates Independently of Host

Visionary 100 is a 300-bps (bit-per-second) programmable 8085 microprocessor-controlled modem that operates independently of the host computer. When your computer is switched off or working on a task, this modem can automatically answer a telephone, receive and store a transmission in its memory, and activate a front-panel message-waiting indicator. Additionally, the Visionary 100 can print a message, complete with date and

What's New?

that the memory is not erased. Control 3 does not involve rebooting from floppy disk; it merely returns you to the DOS prompt.

To receive these programs, send \$6 to cover disk and handling costs to B & L Computer Consultants, Free Programs Numbers 1 and 3, 226 South Cole, Boise, ID 83709. A contribution of \$15 and \$10, respectively, is requested if you find these programs useful.

Circle 581 on inquiry card.

Workshop Helps Atari Programmers

The Disk Workshop from Synergistic Software, a set of seven utility programs for Atari 400/800 computers, is designed to help you with programming functions. Disk Workshop includes disk-editing capabilities, fast copying of disks, a formatted disk directory that can be sent to a printer, the ability to use machine-language character strings in BASIC, a screen dump for the Epson MX-80 printer outfitted with Grafrax or Grafrax Plus, and the ability to transfer large files to disk or cassette. One program in the set, Micro-DOS, gives you a RAM-resident program similar to Atari's DUP.SYS. Micro-DOS is online and available at any time.

The Disk Workshop requires 32K bytes of memory and a single disk drive.

It costs \$34.95 and is available from Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055, (800) 426-6505; in Washington, (206) 226-3216.

Circle 582 on inquiry card.

8087 Coprocessor Products

Microware has introduced a line of products for the 8087 coprocessor implementation on the IBM Personal Computer. The Fastpak includes Intel's 8087 numeric data processor, installation instructions, and your choice of four programming languages. The 87188 Guide, a handbook on using the 8087 processor, accompanies this package. This guide introduces 8087 programming using 87Macro and the IBM Macro Assembler or the CP/M-86 assembler. In addition, it has assembly-language listings that can be keyed in and run on the IBM. The guide can be purchased separately for \$18.95. Fastpak is \$375.

Microware is marketing a variety of languages for use with the processor, most of which require a 128K-byte IBM PC with one disk drive and a compiler. 87Pascal, a library of floating-point routines that directly drive the 8087, is said to increase the speed and accuracy of Pascal programs. For applications demanding numerous transcendental, roots, or powers, Microware offers 87FORTRAN. The 87BASIC package allows you to

perform both single- and double-precision arithmetic with the 8087.

The timesaving 87Macro is designed for applications requiring the full power of the chip. It contains a preprocessor that generates the complete 8087 instruction set and a library of macroinstructions and subroutines to simplify writing 8087 code. A double-sided double-density disk drive and the IBM Macro Assembler are required.

Each language is available as part of Fastpak or separately for \$125. For details, contact Microware Inc., POB 79, Kingston, MA 02364, (617) 746-7341.

Circle 583 on inquiry card.

Modula II Language Lifts Pascal's Restrictions

Volition Systems' Modula II is said to be a simple but powerful high-level programming language that solves the problems inherent in Pascal. Serving as an alternative to assembly language, C, and Ada for systems programming, this language was designed by Niklaus Wirth, the creator of Pascal. Modula (MODular LAnguage) features include modules, processes, separate compilation, dynamic array parameters, and low-level machine access. It consists of a p-code interpreter that's upward compatible with the Apple Pascal interpreter, a one-pass compiler, a library-management utility, and a standard module library.

A small language supple-

mented by library modules, **Modula II** requires a 64K-byte Apple II with the Apple Pascal operating system. The initial release provides access to the Apple Pascal file system and UCSD Pascal intrinsics by means of library modules. The compiler accepts the full Modula II language, as defined in the ETH Zurich Modula II report, with minor implementation restrictions. Programs are compiled into p-code.

Modula II costs \$550. Quantity discounts are offered. Updates and user-support via electronic mail are also available. For further details, contact Volition Systems, POB 1236, Del Mar, CA 92014, (714) 457-3865.

Circle 584 on inquiry card.

Project Nebula

Keith Carlson
43 McDill Rd.
Bedford, MA 01730

In light of the enormous popularity of video games, it's not unusual that imitations of the most popular ones should spring up. After all, consumers spend \$10 billion a year on video arcades, and manufacturers want a slice of the pie. So naturally I expected Project Nebula to be Radio Shack's version of Atari's blockbuster, Star Raiders. Not so. The two games have similarities, but after a thorough investigation I found that Project Nebula's differences in terms of rules and play make it a true original.

Actually, Project Nebula for the TRS-80 Color Computer includes four games. Each game offers you 10 levels that increase in difficulty. Target practice is the first game, and you'll need it. The joystick control is sluggish and difficult to use in the beginning, and practice will help you get comfortable using it. Whether the unusual feel of the joystick was intentional or not, it detracts from the game. Target practice will also introduce you to the short-range sensors (both front and rear views) in the lower corners of the screen. In my initial experience with this practice, I discovered one of Project Nebula's most interesting aspects: the program maintains depth of field.

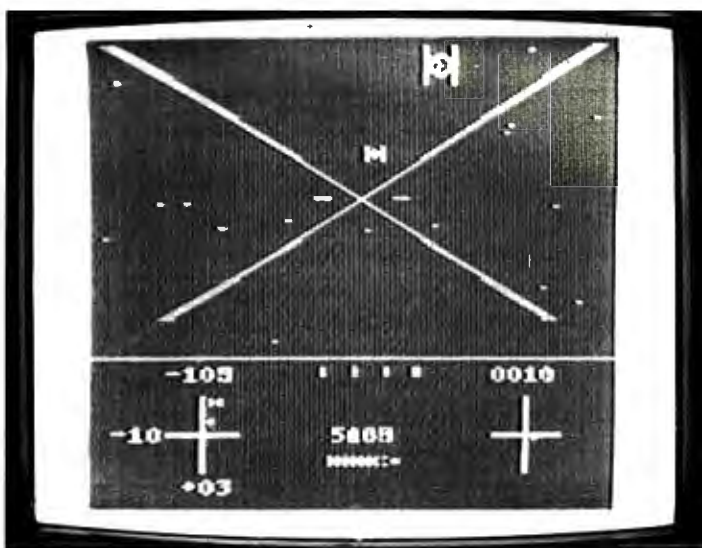


Photo 1: The forward view from your scout vessel is shown in the upper section of the screen. Two Zykon craft have dodged one of your energy bolts (diagonal lines converging in center). At the bottom are your instruments showing direction, energy units, and score.

In other words, if you have two enemy ships in your sights, you can only shoot the one in front. The second ship becomes vulnerable only when it is closer to you than the leftover debris from the enemy you just exploded. And the best part is that you gain all of this wonderful experience under the most ideal conditions; you can shoot the Zykons, but they can't shoot back!

Once you master the joysticks and the range sensors, you're ready for game two. It, too, is target practice, but with a big difference: now the

Zykons are shooting at you. But don't fret too much; your ship is still safe. When you get a direct hit from an enemy bolt, the screen briefly fills with red @ signs, and the game continues. During this game, your other joystick is activated and it controls the forward speed of your craft. That feature isn't particularly useful in the first two games, but it becomes quite significant in subsequent games when you have to dock and refuel.

In the third game, you apply what you've been practicing. Now you have an entire quadrant to patrol, and with a press of the Z key, you view a multicolored map. To travel between sectors, you choose a sector and, by press-

BYTE GAME GRID

At a Glance

Name

Project Nebula

Type

Game

Manufacturer

Tandy Corporation
1 Tandy Plaza
Fort Worth, TX 76102

Price

\$39.95

Author

Robert Arnstein

Format

ROM cartridge

Language

6809 machine language

Computer Needed

TRS-80 Color Computer
(any configuration)

Additional Equipment

Two joysticks

Documentation

8-page manual

Audience

Arcade game players and
Star Wars fans

ing the H key, off you go into "hyperspace." When you move in hyperspace from one sector to another, the graphics resemble those in *Star Wars*. You will travel in hyperspace often. Every time the Zykons zap your ship, you lose energy units. To refuel, you must travel to a sector with a base, dock your ship, and get recharged.

Docking can be tricky. If you forget to reduce your speed at the right time, you will overshoot the base. You must set the ship's horizontal and vertical directions within a certain range, increase your speed until the base is in sight, and then decrease your speed to a specified point. When you are close enough to the base, you will receive a new power pack. Instructions for this procedure are included with the game, and with a little practice docking almost becomes easy.

The fourth and final game of the series pulls out all of the stops. Not only do you lose energy units when your ship is hit, but the accumulated hits begin to take their toll on your vessel. The type and level of damage the hits inflict remains unpredictable. You must remember to check the damage status report, which is displayed to the right of the quadrant map. When it's time for repairs, you must travel to a base.

At this point, finding a base can present quite a challenge. If your long-range sensors are damaged, you'll still be able to display the quadrant map, but the sectors will be randomly filled, making it impossible for you to tell which sector contains what; in my opinion, false information is more frustrating than no information at all. If you didn't memorize which sector has your home base, your only recourse is to conduct a costly sector-by-sector search, consuming large amounts of time and fuel. Trying to use damaged warp engines lands you in a random sector, no matter where you want to go. I find this more maddening than nonfunctional warp engines.

A few relatively minor things about Project Nebula bother me. Its terrible sound effects grated on my nerves and detracted from my ability to enjoy the game. As soon as I turned off the white noise, I had a much better time. Another quibble concerns the strategy for winning. If you're cautious, it's practically impossible to lose. An inexhaustible supply of bases for fuel and repair keep you from serious trouble, provided you memorize the location of your base. My last objection concerns the ending of the game. When you manage to eliminate every last Zykon, all you get is a mere congratulations. A rating based on the number of times you refueled combined with your score would be more gratifying. These problems, however, are trivial compared to Project Nebula's overall enjoyability. ■

Legionnaire

Gregg Williams
Senior Editor

I have always had an extreme dislike for any game that reminds me of a legal contract. I've never liked war games for that reason. The rules always have the length, clarity, conciseness, and type size of the average insurance policy. I have also never been able to deal with war game maps (which are often the size of movie posters) and the number of playing pieces (anywhere from fifty to hundreds of units); I much prefer the playability of simple game mechanisms to complex ones.

Because of all this, I've never been comfortable with war games, even though I've spent considerable hours playing them.

Avalon Hill's Legionnaire changes all that. The name of the game is misleading (for most people, it conjures up images of American Legion veterans trying to get to the Saturday night banquet alive) and the cover art is poor, but those are the only flaws in the presentation of an otherwise perfect solitaire game.

Legionnaire is the most recent game by Atari's Chris Crawford, easily the most innovative and talented person working on the Atari 400/800 computer today. Though his previous game, *Eastern Front*, solves many of the problems of war games, it retains several features that don't suit me—only one scenario with over 50 pieces on each side, a playing time of several hours, and a complexity that intimidates rather than challenges me. (Dyed-in-the-wool war gamers don't have these problems with the game, but I'm sure many feel as I do. I'm happy to report that Chris is working on an enhanced version of *Eastern Front* that has, among other things, various levels of complexity.)

Legionnaire is Crawford's latest war game, and many of its features improve on *Eastern Front*. For example, you can play games of varying complexity and length (the shortest is perhaps 10 minutes), you command between one and ten units, the computer automatically takes care of the enormous amount of calculation and record-keeping that conventional war games require, and—best of all—the game takes place in real time.

In *Legionnaire*, you are Caesar, and you command a force of between one and nine Roman legions. You play on a scrolling topographical map several screens high and wide (see photo 1), and your task is to defeat two barbarian tribes (played by the computer) that are challenging your power. When the game starts, you are asked how many legions you want to play with. You can choose a force of between one and ten legions, the first of which represents Caesar. (As the number of units you possess increases, you receive successively weaker units; the game is easier with smaller forces. Choose five units the first time you play.) You then choose one of twelve barbarian infantry tribes (listed in order of increasing strength and skill) and one of twelve barbarian cavalry tribes. Because each tribe is the same size as your force, you are always outnumbered by two to one. Your force and the two barbarian groups are placed randomly on the map, and the game is ready to begin.

When you press the Start button on the Atari keyboard, the barbarian units begin to move toward you. This is a very unsettling sight, especially compared with *Eastern Front*, in which you had conventional game turns and combat takes place only when you are ready. Not so in *Legionnaire*—the game is in real time and you have no time to spare. You use the joystick and a hollow-square cursor to give each unit up to eight orders, and each unit begins moving as soon as you have finished. The amount of time you need to execute these orders depends on the type of unit, its current characteristics, and the terrain; of course, cavalry units are faster than infantry units, but infantry units are stronger and harder to destroy. In general, units move once every 4 to 30 seconds, which gives you an idea of the pace of the game. The Caesar

(1a)



(1b)



(1c)



Photo 1a–c: *Legionnaire* in action. In this sequence, the cursor (yellow box) moves to the top edge of the screen (1a and 1b). When it needs to move further up, the background scrolls down (1c). You can see this by noting the locations of Caesar (the eagle-shaped pink unit) in each photo.

BYTE GAME GRID

At a Glance

Name

Legionnaire

Type

Arcade-style real-time military-strategy game

Manufacturer

Avalon Hill Microcomputer Games Inc.
4517 Harford Rd.
Baltimore, MD 21214

Price

\$35

Computer

Atari 400 or 800 with cassette recorder, joysticks, and 16K bytes of memory

Author

Chris Crawford

Language

6502 machine language

Documentation

A 20-page manual with game instructions, strategy, an analysis of Roman and barbarian units, and some relevant history

Audience

Game players

unit is both strong and fast, but it has a special liability: if you lose it, you lose the game. When enemy units are adjacent and trying to occupy the same square, they begin to fight each other. Depending on the circumstances, a unit may retreat and/or lose men and swords; if it loses all of its swords, the unit dies and is removed from play.

The current status of each unit is indicated by the number of unwounded men in that unit and a number that reflects their combat strength at the moment due to fatigue and circumstances. In addition, the behavior of each Roman legion and each barbarian tribe is influenced by its overall temperament, which is described in the rulebook for Legionnaire. Such subtle information is of interest to only the experienced Legionnaire player, but it can mean the difference between defeat and victory when you are playing against the toughest opponents.

Of course, there is a lot of strategy to Legionnaire. Beginners should take the Roman troops to the top of the nearest hill and wait for the attack; that way the tired barbarians will have to walk uphill to attack rested Romans. You should also keep the cavalry units from being "pinned"; they should be free to execute a flank (side) or rear attack. See "More Legionnaire Tactics" for more information; you may want to play the game for a while before reading this box.

Conclusions

Legionnaire is a wonderful game that, for me, combines the graphics and movement of arcade games with the depth of strategy games. It also performs the valuable service of making the war game accessible to people who don't like the complexity and tedium of paper-and-card-board war games. I also like the large number of gradations (in both playing time and skill level) it offers;

Legionnaire has 1,440 variations (10 troop sizes times 12 cavalry opponents times 12 infantry opponents). Looking up combat results in a table (the procedure in most war games) has always struck me as a method of combat resolution that gives the players too much information on how combat is decided; seeing only the results of a battle, in real time, gives me a better simulation of war-making. Legionnaire has taught me more about military strategy and tactics than all the war games I've played to date.

Avalon Hill should be congratulated on such a strong game that extends its leadership in the war-gaming field to the microcomputer arena. I only wish that Avalon Hill had given Chris Crawford more prominent credit—if they don't know it by now, Chris's name sells games, and Legionnaire is just one example why. ■

More Legionnaire Tactics

- One tactic for winning Legionnaire is to send one of your cavalry units toward the slower barbarian infantry units. If you are careful, you can get the infantry units to chase your cavalry, thus drawing them away from your main group. The remaining units (mostly infantry) can usually overcome the isolated barbarian cavalry; once that's done, use your cavalry to draw the barbarian infantry back to your main group. It will take some practice to use this tactic successfully.
- If you simply can't give your orders fast enough during a fierce battle, an undocumented feature of this game is to hit the Option key once (hitting it twice ends the game with your surrender). The game pauses (as with the Select key), but here you can give your units orders. Hit the Start key to continue the game. This is, strictly speaking, cheating, and it should be used only when necessary. However, the Huns (the most powerful barbarian cavalry) are impossible to beat, I'm told, so any method of winning is permitted here.

Using SOUND Arguments for High-Precision RTTY

How to generate radioteletype audio frequencies from an Atari 800.

Scott Persson
4719 Valley St.
Omaha, NE 68106

This article focuses on the audio capabilities of the Atari 800 micro-computer. These include synthesized speech, automatic Touch-Tone (a registered trademark of the Bell System) dialing, Morse-code generation, and many more. A direct use of the Atari's sound capabilities may be demonstrated by the ease with which it will generate the proper sound frequencies for the transmission of amateur radioteletype. With only a shielded cable between the Atari's monitor jack and the VHF (very high frequency) radio as interface, a completely new method of "interfaceless" data transmission for microcomputers is born. Previously, microcomputers had been sending radioteletype by controlling expensive out-board tone generators, but with the Atari 800's four built-in tone generators, who needs the expense of an interface?

Introduction to RTTY

Amateur radioteletype (RTTY) signals are composed of two precise audio-frequency tones which alternate in patterns to produce character combinations, usually in the five-

level Baudot or Murray code. The higher of the two tones is the *space* tone and the lower is the *mark* tone. The difference in frequency between the space and the mark tones is the *shift*. Radioteletype normally uses two shifts; the mark tone for both has been standardized at 2125 Hz (hertz,

With the Atari 800's four built-in tone generators, who needs the expense of an interface?

or cycles per second). For a 170-Hz shift, the space tone is 2295 Hz (2125 + 170); for an 850-Hz shift, the space tone is 2975 Hz (2125 + 850). The Atari 800 will generate some of these frequencies.

Simple Audio-Frequency Generation

The sound generators within the Atari are clocked at 63.921 kHz (kilohertz). Each generator is associated with a memory location

and the value within that location is constantly being decremented from 255 to 0 at the clock frequency. The decrement interval is determined by the Atari BASIC SOUND statement parameters. The frequency of the audio that is produced is determined by the number of times per second that the corresponding memory location counts down to 0. The exact frequency of a SOUND statement can be determined with the following equation:

$$F_{\text{OUT}} = \frac{F_{\text{IN}}}{2N} \quad (1)$$

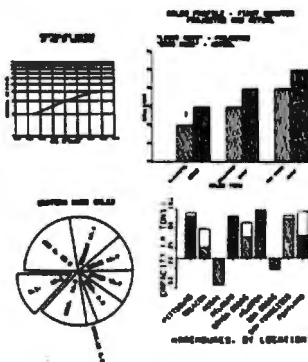
where F_{OUT} is the frequency actually obtained from the computer, F_{IN} is 63,921 Hz, and N is the second SOUND command parameter (0 to 255) plus 1.

For example, N would equal $14 + 1$, or 15, in the command "SOUND 0,14,10,15." We can compute the exact frequency as follows:

$$\begin{aligned} F_{\text{OUT}} &= \frac{F_{\text{IN}}}{2N} \\ &= \frac{63,921}{2(15)} \end{aligned}$$

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BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
-------	-------	-------	-------	-------	-------	-------	-------

Bit Function

- | | |
|---|--|
| 7 | Not discussed. |
| 6 | Clock Generator 1 with 1.789790 MHz, instead of 63.9210 kHz. |
| 5 | Clock Generator 3 with 1.789790 MHz, instead of 63.9210 kHz. |
| 4 | Clock Generator 2 with Generator 1, instead of 63.9210 kHz. |
| 3 | Clock Generator 4 with Generator 3, instead of 63.9210 kHz. |
| 2 | Not discussed. |
| 1 | Not discussed. |
| 0 | Change normal clock frequency of 63.9210 kHz to 15.6999 kHz. |

Figure 1: The 1-byte audio-control register (AUDCTL) shown as bit 0 through bit 7. AUDCTL is used to link generators together and to increase the clock rate.

$$= \frac{63,921}{30}$$

$$= 2130.69 \text{ Hz}$$

This result is fairly close to our mark tone of 2125 Hz. In fact, this tone works just fine for radioteletype. The space tone of 2295 Hz used in 170-Hz shift can be approximated by making N equal 13 to get 2282.89 Hz. I used this combination in my teletypewriter program (see listing 1) for several months until the local hams converted to an 850-Hz shift (2975 Hz). In order to generate 2975 Hz, you must make N equal 10.74, an impossibility because the SOUND statement rounds all arguments into integers. Thus, 10.74 becomes 10, which yields a frequency of 3196 Hz.

Complex Audio-Frequency Generation

High-precision sound generation is possible because the Atari's designers allow you to link two of the four sound generators together, so you're not limited to an 8-bit integer number. Thus, the range of the SOUND parameter can be expanded from 0 through 255 (0 through FF hexadecimal) to 0 through 65,535 (0 through FFFF hexadecimal). This means passing the generators 16 bits of information, rather than 8 bits. To do so, you cannot use the SOUND statement; all instructions and infor-

mation passed to the generators must be entered directly into memory using the POKE statement.

To link the generators, you must become somewhat familiar with AUDCTL, the audio-control register (see figure 1). AUDCTL is located at memory address 53,768 (D208 hexadecimal) and writes data into the audio-mode control register. In order to link generators 1 and 2, bit 4 must be a 1; to link generators 3 and 4, bit 3 must be a 1. These bits are turned on by entering into the AUDCTL register a decimal number which is the sum of the powers of 2 that correspond to the bits you want turned on. For example, to turn on bits 3 and 4, add 2^3 and 2^4 ($8 + 16$) to get 24, and place that value into AUDCTL with the POKE statement.

The added audio-frequency precision requires the use of a faster clock rate for the generator pairs. Normally, the clock rate is 63.921 kHz and bits 0, 5, and 6 of AUDCTL are zero. To get a faster rate, turn on bit 5 if generators 1 and 2 are paired or bit 6 if generators 3 and 4 are paired. The new clock rate is 1.78979 megahertz (MHz). The increased clock rate means that a new equation is necessary to determine the output:

$$F_{\text{OUT}} = \frac{F_{\text{IN}}}{2(N+M)} \quad (2)$$

where F_{OUT} is the frequency actually

```

1 REM *****
2 REM * 40WPM ATARI RTTY PROGRAM *
3 REM * ALL RIGHTS RESERVED *
4 REM * PROGRAMMER: SCOTT PERSSON. *
5 REM * DATE: 04-07-81. *
6 REM * MEMORY: 10420 BYTES *
7 REM *****
8 CLR :POKE 752,1:GOTO 13
9 REM ***** BAUDOT GENERATOR *****
10 A=A(1,P):B=A(2,P):C=A(3,P):D=A(4,P):E=A(5,P):V=A(6,P):POKE 53760,SF:FOR T=1 TO 5:NEXT T:POKE 53760,A
11 FOR T=1 TO 6:NEXT T:POKE 53760,B:FOR T=1 TO 5:NEXT T:POKE 53760,C:FOR T=1 TO 6:NEXT T:POKE 53760,D
12 FOR T=1 TO 5:NEXT T:POKE 53760,E:FOR T=1 TO 6:NEXT T:POKE 53760,MF:FOR T=1 TO 8:NEXT T:RETURN
13 REM ***** FREQUENCY INPUT *****
14 ? ">";:<ENTER MARK FREQUENCY> ";;INPUT MF:MF=(1789790/(2*MF))-7:IF MF-INT(MF)>=0.5 THEN MF=INT(MF+1)
15 ? "? ">:<ENTER SPACE FREQUENCY> ";;INPUT SF:SF=(1789790/(2*SF))-7:IF SF-INT(SF)>=0.5 THEN SF=INT(SF+1)
16 MF=INT(MF-256):SF=INT(SF-256):POKE 53768,120:POKE 53762,1
17 REM ***** MAIN *****
18 DIM A(6,124):POKE 82,2:POKE 764,255:POKE 83,36:? ">";:POSITION 2,1:? "<PLEASE WAIT>";:FOR T=1 TO 56
19 READ A:READ B:READ C:READ D:READ E:READ F:READ G:READ H:A(0,A)=B:A(1,A)=C:A(2,A)=D:A(3,A)=E:A(4,A)=F
20 A(5,A)=G:A(6,A)=H:NEXT T:GOSUB 41:POSITION 2,1:? "<STDBY> ATARI 800 TELETYPE";:L=0:V=0:GOTO 38
21 IF PEEK(764)=255 THEN POKE 77,1:GOTO 21
22 P=PEEK(764):POKE 764,255:IF P=12 THEN 32
23 IF P=124 THEN GOSUB 10:GOTO 21
24 IF P=60 THEN GOSUB 10:GOTO 21
25 IF P=28 THEN 35
26 IF P=39 THEN 37
27 IF L>64 THEN SETCOLOR 2,2,8
28 L=L+1:IF L=71 THEN P=12:GOTO 32
29 IF ((A(0,P)>64 AND A(0,P)<91) OR P=33) AND V=1 THEN R=P:P=60:GOSUB 10:P=R:GOTO 31
30 IF (A(0,P)<65 OR A(0,P)>90) AND P<>33 AND V=0 THEN R=P:P=124:GOSUB 10:P=R
31 GOSUB 10:? CHR$(A(0,P));:GOTO 21
32 SETCOLOR 2,9,4:GOSUB 10:P=28:GOSUB 10:P=60:GOSUB 10:L=0:IF PEEK(84)<21 THEN 34
33 ? ">";:POSITION 2,1:? "<TRANSMIT> ATARI 800 TELETYPE";? :POKE 752,0:GOTO 21
34 POSITION 2,PEEK(84)+1:? " ";:GOTO 21
35 IF PEEK(84)<21 THEN GOSUB 10:POSITION PEEK(85),PEEK(84)+1:? " ";:GOTO 21
36 GOSUB 10:POKE 84,3:POSITION PEEK(85),PEEK(84):? " ";:GOTO 21
37 GOSUB 45:POSITION 2,1:? "<STDBY> " :POKE 764,255:POKE 752,1
38 IF PEEK(764)<>39 THEN POKE 77,1:GOTO 38
39 GOSUB 45:? ">";:POSITION 2,1:? "<TRANSMIT> ATARI 800 TELETYPE";? :POKE 752,0:? " ";:GOTO 21
40 POKE 764,255:POKE 53760,MF:POKE 53763,226:GOTO 21
41 REM ***** ARRAY CONVERSION *****
42 FOR X=1 TO 5:FOR Y=0 TO 124:IF A(X,Y)=1 THEN A(X,Y)=SF:GOTO 44
43 A(X,Y)=MF
44 NEXT Y:NEXT X:RETURN
45 REM ***** MORSE ID *****
46 POKE 752,1:POSITION 2,1:? "<IDENTIFY> " :POKE 53760,25:P=7:GOSUB 51:P=21:GOSUB 51:GOSUB 51
47 FOR T=1 TO 21:NEXT T:GOSUB 51:P=7:FOR S=1 TO 3:GOSUB 51:NEXT S:FOR T=1 TO 21:NEXT T
48 P=21:FOR S=1 TO 5:GOSUB 51:NEXT S:FOR T=1 TO 21:NEXT T:GOSUB 51:GOSUB 51:P=7:GOSUB 51:P=21

```

Listing 1 continued on page 440

Listing 1 continued:

```
49 GOSUB 51:FOR T=1 TO 21:NEXT T:P=7:FOR S=1 TO 2:GOSUB 51:P=21:GOSUB 51:GOSUB 5
1:P=7:GOSUB 51
50 FOR T=1 TO 21:NEXT T:NEXT S:POKE 53760,MF:RETURN
51 POKE 53763,226:FOR T=1 TO P:NEXT T:POKE 53763,224:FOR T=1 TO 5:NEXT T:RETURN
900 DATA 63,65,0,0,1,1,1,0
901 DATA 21,66,0,1,1,0,0,0
902 DATA 18,67,1,0,0,0,1,0
903 DATA 58,68,0,1,1,0,1,0
904 DATA 42,69,0,1,1,1,1,0
905 DATA 56,70,0,1,0,0,1,0
906 DATA 61,71,1,0,1,0,0,0
907 DATA 57,72,1,1,0,1,0,0
908 DATA 13,73,1,0,0,1,1,0
909 DATA 1,74,0,0,1,0,1,0
910 DATA 5,75,0,0,0,0,1,0
911 DATA 0,76,1,0,1,1,0,0
912 DATA 37,77,1,1,0,0,0,0
913 DATA 35,78,1,1,0,0,1,0
914 DATA 8,79,1,1,1,0,0,0
915 DATA 10,80,1,0,0,1,0,0
916 DATA 47,81,0,0,0,1,0,0
917 DATA 40,82,1,0,1,0,1,0
918 DATA 62,83,0,1,0,1,1,0
919 DATA 45,84,1,1,1,1,0,0
920 DATA 11,85,0,0,0,1,1,0
921 DATA 16,86,1,0,0,0,0,0
922 DATA 46,87,0,0,1,1,0,0
923 DATA 22,88,0,1,0,0,0,0
924 DATA 43,89,0,1,0,1,0,0
925 DATA 23,90,0,1,1,1,0,0
926 DATA 31,49,0,0,0,1,0,1
927 DATA 30,50,0,0,1,1,0,1
928 DATA 26,51,0,1,1,1,1,1
929 DATA 24,52,1,0,1,0,1,1
930 DATA 29,53,1,1,1,1,0,1
931 DATA 27,54,0,1,0,1,0,1
932 DATA 51,55,0,0,0,1,1,1
933 DATA 53,56,1,0,0,1,1,1
934 DATA 48,57,1,1,1,0,0,1
935 DATA 50,48,1,0,0,1,0,1
```

Listing 1 continued on page 442

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Listing 1 continued:

```

936 DATA 60,32,0,0,0,0,0,0
937 DATA 124,32,0,0,1,0,0,1
938 DATA 12,32,1,1,1,0,1,0
939 DATA 33,32,1,1,0,1,1,0
940 DATA 14,45,0,0,1,1,1,1
941 DATA 88,36,0,1,1,0,1,1
942 DATA 95,33,0,1,0,0,1,1
943 DATA 91,38,1,0,1,0,0,1
944 DATA 90,35,1,1,0,1,0,1
945 DATA 115,39,0,0,1,0,1,1
946 DATA 112,40,0,0,0,0,1,1
947 DATA 114,41,1,0,1,1,0,1
948 DATA 94,34,0,1,1,1,0,1
949 DATA 38,47,0,1,0,0,0,1
950 DATA 66,58,1,0,0,0,1,1
951 DATA 2,59,1,0,0,0,0,1
952 DATA 102,63,0,1,1,0,0,1
953 DATA 32,44,1,1,0,0,1,1
954 DATA 34,46,1,1,0,0,0,1
955 DATA 28,28,1,0,1,1,1,0

```

The Radioteletype Program

The program I used to implement radioteletype frequencies is presented in listing 1. The following paragraphs comment on the significant lines of the program.

Lines 10 through 12 (timing loops) must be placed at the program's beginning because the BASIC interpreter looks for line calls (GOTO and GOSUB) from line 0. If the loops were any deeper in the program, the timing loop delays would be in error.

Lines 14 and 15 contain the input routine, where you enter the mark and space frequencies you wish to use.

Line 16 sets up the high-precision generator pair, then sets the high-order byte of the pair to 1, which will make the pair generate at radioteletype frequencies.

Lines 18 and 19 read character data into A, a two-dimensional array, using scalar variables A through H (see DATA statements in lines 900 through 955). Of these variables, A represents the keyboard code for the key that will be pressed, B is the ATASCII (Atari ASCII code) equivalent for the character in variable A, variables C through G collectively form the 5-bit Baudot equivalent (0 for mark tone and 1 for space tone), and H is a figures/letters-shift flag. H equals 0 if the character is

in lower (letters) shift, 1 if the character is in upper (figures) shift.

Line 21 looks for keyboard input from memory location CH (hexadecimal 01FC).

Lines 22-26 look for special-case RTTY characters, such as A (the Atari-logo key), Carriage Return, Linefeed, Ltrs (letters shift), Figs (figure shift), and Bell. The program includes automatic up- and down-shifting, and will generate a combined Linefeed/Ltrs upon receipt of a Carriage Return. The program loops constantly until the Atari-logo key is pressed. The Atari-logo key will also terminate RTTY transmission and return the program to standby looping.

Line 27 changes the screen color when over 64 characters have been typed on one line, to remind you that only 5 characters remain on a standard RTTY line. If you continue to type, a combined Carriage Return/Linefeed/Ltrs will be sent automatically when you reach 70 characters.

Lines 46 through 51 contain the Morse-code identification routine. This must be changed for your call sign. To do so, change the values of P (dit = 7, dah = 21), the number of repetitions (GOSUB 51), and the placement of the delays between characters (FOR T = 1 to 21:NEXT T). The existing call sign is WB0QPP.

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BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	
1	0	1	0	0	0	0	0	- OFF
1	0	1	0	1	0	0	0	- 1/2 VOLUME
1	0	1	0	1	1	1	1	- FULL VOLUME

Figure 2: The audio-control registers (AUDC1 to AUDC4) control the volume of the corresponding audio generator (1 to 4). The volume range is from 224 to 239 decimal.

Text continued from page 438:

obtained from the computer, F_{IN} is 1,789,790 Hz (1.78979 MHz), N is the number to be passed to the generator pair, and M is always 7 for a generator pair.

For example, we'll find the value of N to yield the space tone 2975 Hz used in 850-Hz shift radioteletype:

$$F_{OUT} = \frac{F_{IN}}{2(N+7)}$$

$$2975 = \frac{1,789,790}{2(N+7)}$$

$$N = 293.8$$

The closest integer value for N is 294. By passing the generator pair 294, we get an audio-output frequency of 2973.07 Hz, only about 0.06 percent off our goal.

Our next problem is to put the value 294 into memory. Obviously it cannot be entered as an 8-bit integer because the maximum integer value is 255. However, by passing the generator pair 16 bits of information we can easily denote the decimal number 294 in two 8-bit "pieces." First, convert the decimal number obtained from equation 2 into a 2-byte hexadecimal number: the decimal number 294 equals the hexadecimal number 0126. The two most significant digits (01) make up the *high-order byte* and the two least significant digits (26) make up the *low-order byte*. Next, convert each hexadecimal byte back to its decimal value, individually: 01 hexadecimal equals 1 decimal and 26

hexadecimal equals 38 decimal. These numbers are then passed to the audio-frequency registers (AUDF1 through AUDF4). Using the POKE command, place the high-order byte into the high AUDF register of the pair and the low-order byte into the low AUDF register.

Volume Control

Once the frequency is determined, the volume must be set because its default value is zero. The volume is controlled by the audio-channel control registers (AUDC1 through AUDC4, see figure 2). Because the generators are paired, it is necessary to turn on only AUDC2 or AUDC4 for output. For full volume, use the POKE command to place the number 239 into the appropriate AUDC; for zero volume, use POKE to enter the number 224. The values within that range will vary the volume proportionately.

Putting It Together

To create high-precision audio, follow these steps:

- Set up the generator pair(s) and increase the clock rate by changing the AUDCTL register with the POKE command.
- Choose an output frequency and obtain N from equation 2.
- Split N into two hexadecimal bytes and then convert each byte into its decimal equivalent.
- Use the POKE command to place

Listing 2: This short program will set up generator pairs 1 and 2 and 3 and 4 and prepare them for high-precision sound generation. To obtain a given frequency, use the number N from equation 2 in the format HB (high-order byte) and LB (low-order byte); e.g., for 1050 Hz the number is 845. HB = 845/256 or 3; LB = 77 (the remainder). The value for VOLUME should be determined empirically.

```

10 POKE 53768,120
20 POKE 53762,HB
30 POKE 53760,LB
40 POKE 53763,VOLUME

REM SETS UP THE PAIRS
REM HB -- HIGH ORDER BYTE
REM LB -- LOW ORDER BYTE
REM VOLUME = 160(OFF) TO 175(FULL)

```

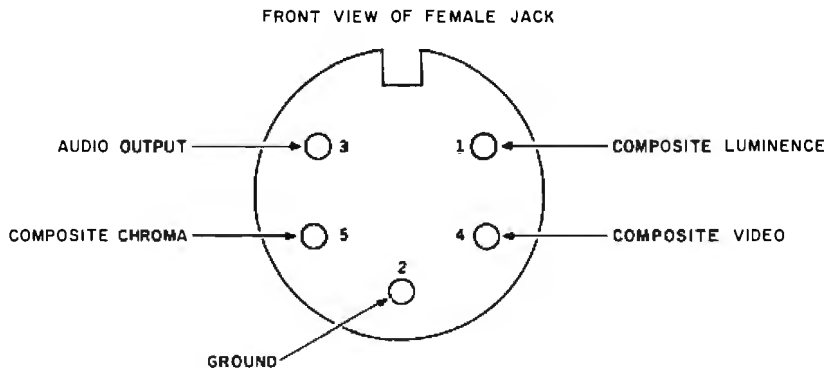


Figure 3: The pinout from the Atari monitor jack (front view). The audio frequencies are taken from pins 2 and 3.

A BASIC assembly-language version of the RTTY program is available on cassette from the author for \$15. It features RTTY transmission and reception at any speed and any audio shift. It comes preprogrammed with the individual's call sign. For information send a stamped, self-addressed envelope to:

Scott Persson WB0QPP
4719 Valley St.
Omaha, NE 68106

the high byte into the high AUDF of the generator pair and the low byte into the low AUDF.

• Choose a volume level and use POKE to place the value (224 to 239) into either AUDC2 or AUDC4.

You can use the program presented in

listing 2 to experiment with high-precision frequency generation.

The audio output from the Atari comes from the monitor jack, which is located on the right side of the computer near the peripheral jack (see figure 3). The audio frequencies are taken from pins 2 and 3; note that pin

2 is the ground. A 5-pin DIN (Deutsche Industrie Norm) plug and shielded audio cable are the only interface necessary. There are few hams who can boast of 99.94-percent tone accuracy—much less a \$2 interface—and it's all accessible with a little SOUND thinking. ■

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Software Received

Apple

APAD 2.0, a set of three programs for designing impedance matching and attenuation circuits for use in audio-frequency transmission circuits. The programs design T, PI, H, and O pads. For the Apple II Plus; cassette or floppy disk, \$15. Forbes Enterprises, 21832 99th Ave. SE, Snohomish, WA 98290.

Apple BASIC: Data File Programming, a book and software combination. This package shows you how to create and maintain data files. Using a step-by-step approach, you can write a simple database-management program. For the Apple II; floppy disk, \$19.95. Wiley Professional Software, 1 Wiley Dr., Somerset, NJ 08873.

Banner Magic, a program that can create lettered banners. Using any printer, you can enter your message and have it printed with letters up to 7 inches high. Program options are entered via a menu. For the Apple II; floppy disk, \$24.95. Phoenix Software Inc., 64 Lake Zurich Dr., Lake Zurich, IL 60047.

Computing Without Mathematics, a book and software combination. This package offers a hands-on approach to learning the essentials of BASIC and Pascal. Word processing and data management are also covered. For the Apple II; floppy disk, \$25. Microcomputer Educational Materials, POB 6184, Santa Barbara, CA 93111.

Editor/Assembler, an editor and assembler package that features disk-oriented, menu-driven operation within memory emulation. This package includes full-screen editor and detailed manual. For the Apple II; floppy disk, \$89.95. Custom Micro Systems Ltd., 16921 108th St., Edmonton, Alberta T5X 3B2, Canada.

Interstellar Sharks, an adventure-type game. You become a member of a vast galactic corporate empire. Your goal is to reach the planet Triskelion by choosing a character and following a career path to success. For the Apple II; floppy disk, \$32.95. Interactive Fantasies Inc., 28035 Dorothy Dr., Agoura, CA 91301.

Jawbreaker, an arcade-type game. You find yourself in a candy store. You must negotiate a maze, eat the candy, and avoid the happy faces which are trying to catch you and pull your teeth. For the Apple II and III; floppy disk, \$29.95. Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.

Linear Programming Model, a program to develop a model for the allocation of resources based on mathematical formulas. Variables in the formula correspond to resources and resource constraints. For the Apple II; floppy disk, \$29.95. Microphase Systems, POB 10461, Tallahassee, FL 32302.

Lunar Leeper, an arcade-type game for one player. You start by rescuing your men from the Lunar Leepers and progress toward the destruction of the giant eyeball. Eight levels of play. For the Apple II and III; floppy disk, \$29.95. Sierra On-line Inc. (see address above).

Micro on the Apple, Volume 3, a book and software combination. This package includes programming aids for Applesoft and machine language, graphics utilities, games, and tutorial and reference articles. For the Apple II; floppy disk, \$24.95. Micro Ink Inc., POB 6502, Chelmsford, MA 01824.

PFS: Graph on the Apple III, a graphics development package. It is designed to pro-

duce bar, line, or pie charts with labels and to work with the PFS:File package, Visicalc files, or to stand alone. For the Apple III; floppy disk, \$125. Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94043.

Pest Patrol, an arcade-type game. The object of this game is to kill all the insects. You are given five cans of bug spray to use. But beware: the bugs are tough and fight back with bombs. For the Apple II and III; floppy disk, \$29.95. Sierra On-line Inc. (see address above).

Proof, a spelling checker/proofreader program. It can accept input from the keyboard or floppy disk. Files can be either ASCII, text, or binary. The dictionary contains 44,711 words. For the Apple II; floppy disk, \$192. Cambrian Software, Gwynnlllys, Groeslon, Caernafon, Gwynedd, LL54 7ST, Wales.

Sherwood Forest, a graphics adventure-type game. You must help Robin Hood win the hand of Maid Marian. You control his actions through simple commands in order to move around Sherwood Forest. For the Apple II; floppy disk, \$34.95. Phoenix Software Inc. (see address above).

Spy's Demise, an arcade-type game. Your mission is to find the solution to the secret code. You must avoid the guards and collect the clues that are hidden throughout the diplomatic mission. For the Apple II; floppy disk, \$29.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

Atari

Basics of Animation, a set of tutorial programs designed to show you how to move shapes on a video screen. The package covers the PRINT and PLOT commands and

the use of player/missile graphics. For the Atari 400/800; floppy disk, \$19.95. Educational Software Inc., 4565 Cherryvale Ave., Soquel, CA 95073.

Dragonstomper, an arcade- and adventure-type game. You have been cast back into the past where you must battle and search for the Amulet of the Druids. The game features three levels of play. For the Atari Video Computer System; cartridge, \$17.95. Starpath Corp., POB 209, Santa Clara, CA 95050.

The Home Filing Manager, a simple database-management program. The program and manual help you develop your own computerized filing system using an index-card format for data storage. For the Atari 400/800; floppy disk, \$49.95. Atari Inc., 1312 Crossman Rd., POB 61657, Sunnyvale, CA 94086.

Mad-Netter, an arcade-type game. As the Mad-Netter, you must try to capture all the butterflies to score points. But beware of the killer bees, slimy snakes, and mad dogs. For the Atari 400/800; floppy disk, \$34.95. Computer Magic Ltd., POB 2634, Huntington Station, NY 11745.

Monster Maze, an arcade-type game. You are trapped in a three-dimensional maze and more than 40 mutants are chasing you. You must collect gold bars and vitamins to escape. For the Atari 400/800; cartridge, \$39.95. Epyx/Automated Simulations Inc., 1043 Kiel Court, Sunnyvale, CA 94086.

Platter Mania, an arcade-type game. You become a circus performer doing the famous spinning plate trick. Keep your plates spinning on the sticks; the more plates, the higher your score. For the Atari 400/800; cartridge, \$39.95. Epyx/Automated Sim-

ulations Inc. (see address above).

Pogoman, an arcade-type game. As Pogoman, you must help the city conserve electricity by turning off all the street lights. You leap about avoiding cars, cats, chickens, and fire hydrants. For the Atari 400/800; floppy disk, \$39.95. Computer Magic Ltd. (see address above).

Sound & Music, an educational program. This package introduces Atari computer owners to audio programming techniques. It ranges from simple SOUND statements to chords and complete songs. For the Atari 400/800; floppy disk, \$19.95. Educational Software Inc. (see address above).

Speedway Blast, an arcade-type game. Your neighborhood has been invaded by asphalt-eating monsters. You must jump into your hot rod and blast the buggers. You must be wary of monster eggs and holes. For the Atari 400/800; cartridge, \$39.95. Innovative Design Software Inc., POB 1658, Las Cruces, NM 88004.

CP/M

AList, a database-manage-

ment program. This program is set up to handle alphabetically ordered information (e.g., telephone or mail lists), but can be configured for other uses. For CP/M-based systems; floppy disk, \$150. Honor System Software, 2562 East Glade, Mesa, AZ 85204.

Forest, an adventure-type game. The King has given you a mission to complete in his forest. It may be as simple as gathering firewood or as difficult as destroying an evil creature. For CP/M-based systems; floppy disk, \$29.95. Centaur, 501 Jackson, Charleston, IL 61920.

Trakmaster, a disk-library cataloging system. This system lets you maintain expanded descriptions of each file, locate a file by its description, and easily make backups and copies of files. For the CP/M-based systems; floppy disk, \$150. Microfusion, Suite 105, 5580 La Jolla Blvd., La Jolla, CA 92037.

IBM Personal Computer

Expense-Track I, a menu-driven program to keep track of expenses in the home or small business. Each expense has a date, description,

category, method and payment code, and tax status. For the IBM Personal Computer; floppy disk, \$29. Sapana Micro Software, 1305 South Rouse, Pittsburg, KS 66762.

Fun Key, a utility to program IBM Personal Computer function keys. All 10 keys can be programmed for commonly used commands. Files of function-key commands can be saved for use with any applications program. For the IBM Personal Computer; floppy disk, \$24.95. Bourbaki Inc., 431 Main St., Boise, ID 83702.

Galactic Encounters, a Star Trek-type game. You become the commander of an Illiad Star Cruiser. You must destroy all the Kaons in your galaxy. Your ship is equipped with phasers, torpedoes, and energy shields. For the IBM Personal Computer; floppy disk, \$34.95. Micro Productions Inc., POB 147, Georgetown, TX 78626.

Invoice-Generator-PA/DO, a program to maintain and print invoices for a dentist's office. Based on forms for the Illinois Department of Public Aid, this program stores data on up to 275 invoices per disk.

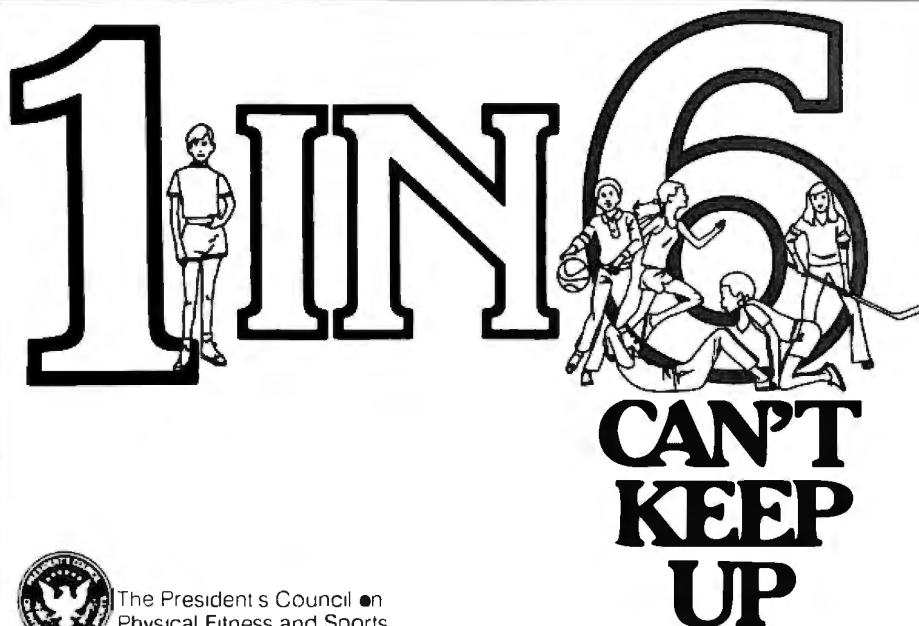
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Mail-Track I, a mailing-list maintenance program. This program keeps your mailing list in ZIP code order and allows you to search, sort, edit, and delete entries. It can attach special messages to labels, as well as print the labels. For the IBM Personal Computer; floppy disk, \$29. Sapana Micro Software (see address above).

Xywrite, a text-editing system that edits standard ASCII text files. It can merge files and print while editing. Online prompting is standard. For use with 40- or 80-column displays. For the IBM Personal Computer; floppy disk, \$50. Xyquest Inc., POB 372, Bedford, MA 01730.

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An excellent description of the S-100 bus and interfacing other buses to it can be found in the book by Elmer C. Poe and James C. Goodwin The S-100 & Other Micro Buses, published by Howard W. Sams & Co. Inc. . . . Steve

Dear Steve,

I own an Atari 800 and wish to increase its memory (it has 24K bytes now). While reading a recent issue of *BYTE*, I saw an ad for a 128K-byte RAM card. But as I understood it, the Atari can use only 48K bytes of memory. How can the Atari use the additional 80K bytes? Also, what is bank-selected memory and how is it used?

Mark Webb
Miles City, MT

More than 48K bytes can be addressed by a technique known as bank selecting. By using one of the I/O ports, different blocks of memory can be selected and addressed. In the case of the 128K-byte RAM card, an additional 104K bytes of memory are available for program storage. This memory can be used as if it were a disk, but it's much faster because its access time is on the order of microseconds.

With this arrangement, it is possible to load many graphic pictures into memory and call them to the screen very quickly. A database or dictionary can also be bank-selected to decrease search time. . . .

Steve

Dear Steve,

My company recently bought a Radio Shack TRS-80

Model II. We also have a neglected Texas Instruments Silent 700 portable terminal (from our timesharing days). Is there a way to use the TI terminal as a printer? If so, how?

Gary G. Schwartz
New York, NY

Connecting a terminal to a computer is simply a matter of wiring it to the serial or parallel port. Use the Model II's serial port in your case. The TRSDOS operating system has printer setup commands that allow proper configuration of your particular printer.

Because there are so many versions of the TI Silent 700, it's possible that the input port on your unit has an acoustic coupler, rather than a serial-interface port. It is then necessary to go inside the box and find the serial output from the coupler. Consult TI for information or obtain the terminal's schematic diagram to see how this can be accomplished.

As a last resort, an inexpensive modern such as the one described in this month's Circuit Cellar, "Build the FCM-103. An Originate/

Answer Modem" (page 26), can be connected between the terminal and the computer. This would eliminate any internal wiring and still provide the printer features. . . . Steve

The Pickles & Trout TVM-04 direct-entry video kit mentioned in the January 1983 Ask BYTE is no longer available. I apologize for any inconvenience this may have caused. . . . Steve■

In "Ask-BYTE," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

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Letters

Another Atari Character Editor

In his article "Character Editor for the Atari" (December 1982 BYTE, page 167), Tim Kilby says, "While several character editors are available commercially, none are specifically designed for use with ANTIC 4 and ANTIC 5 modes." That's not quite accurate.

I am the author of The Next Step, published by Sierra On-Line. It is an Atari graphics package centered around the idea of redefined character sets and has been on the market for about a year. Among other features, it contains explanations and example programs similar to those found in Mr. Kilby's article. The Next Step contains a powerful, easy-to-use character editor that fully supports ANTIC modes 4 and 5. As a matter of fact, it is the character editor that John Harris used for both the ANTIC mode 4 background and the player-missile graphics in his Atari version of Frogger.

As Tim Kilby says, redefined character sets are one of the most powerful features of the Atari computers. When teamed with custom display lists, as supported by The Next Step, impressive graphics are well within the reach of the BASIC programmer. Thank you for your help in spreading this knowledge.

Bob Stewart
The Logic Smiths
Pine Trail
Groton, MA 01450

Problems with FORTRAN-86

The problem with microcomputer FORTRAN compilers is more widespread than indicated by the letters from David Dunthorn and T. M. Putnam criticizing Microsoft's FORTRAN-80 and IBM Personal Computer FORTRAN, respectively (December 1982 BYTE, page 22). Version 1.0 of Intel's FORTRAN-86 (for Intel's 8086-based microprocessor development systems) incorrectly compiles data statements that use repeat factors, generates numerical error codes that are not documented in the Intel FORTRAN-86 User's Guide, frequently creates bad object code for operations involving 4-byte integers, and recently refused to compile an 8-line subroutine whose only executable statements were a type-conversion, an integer multiply, and RETURN.

Software Received

the Apple II; floppy disk, \$19.95. Artsci Inc. (see address above).

Magic Window NEC, a printer-driver program for the NEC Spinwriter that uses the Magic Window word-processing system. For the Apple II; floppy disk, \$19.95. Artsci Inc. (see address above).

Magic Window II, a word-processing system. This improved version of the Magic Window system features a 70-column uppercase and lowercase display, 160-character line length, and hard-disk support. For the Apple II; floppy disk, \$149.95. Artsci Inc. (see address above).

Magic Words, a spelling-checker system. This program features a 14,000-word dictionary that can be customized. It works with any Apple-compatible word-processing program that uses standard Apple DOS. For the Apple II; floppy disk, \$69.95. Artsci Inc. (see address above).

Microbe: The Anatomical Adventure, an adventure game based on medical facts. You command a miniature submarine through your patient's body, fighting off deadly organisms as you go. For the Apple II; floppy disk, \$44.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

Micro Mother Goose, a set of games and animated stories. Designed for children aged 3 to 9 years, this package provides three games and nine animated comics with traditional music. For the Apple II; floppy disk, \$39.95. Software Productions Inc., 2357 Southway Dr., POB 21341, Columbus, OH 43221.

Modula-2, a general-purpose programming language designed for systems implementation. Written by Niklaus Wirth, the author of Pascal, Modula-2 is based in part on Pascal and features modules and separate compilation. For the Apple II and III; floppy disk, \$550. Volition

Systems, POB 1236, Del Mar, CA 92014.

Paint Master, a design utility program that allows you to draw or paint high-resolution pictures on the screen, fill in colored sections, and save the drawings on disk. For the Apple II Plus; floppy disk, \$34.95. Avant-Garde Creations, POB 30160, Eugene, OR 97403.

Pandemonium, a challenging word game that contains a built-in dictionary. See how many words you can spell from the letters in a 5 by 5 grid. For one or more players. For the Apple II; floppy disk, \$39.95. Soft Images (see address above).

The Prime Plotter, a statistical-analysis and graphics development package. Using menu-driven commands, you can create a variety of charts and have them printed or drawn by a plotter. For the Apple II Plus; floppy disk, \$239.95. Primesoft Corp., POB 40, Cabin John, MD 20818.

Puss in Boot, an educational program to teach positional concepts to children from preschool through the primary grades. Graphics appear at random to demonstrate In, Out, Left, Right, On, Off, Over, Under, and more. For the Apple II Plus; floppy disk, \$25. Island Software (see address above).

Repton, an arcade-type game. You control the Star Fighter *Armageddon*. Your mission is to save Repton from the Quarriors. You have a laser gun, radar screen, and energy shields. For the Apple II; floppy disk, \$39.95. Sirius Software Inc. (see address above).

Roadsearch, a computerized road atlas. This database of 406 cities and road junctions in the U.S. and Canada allows you to enter a starting point and a destination. You receive a detailed route plan for your next trip by car and save time, money, and gas.

For the Apple II Plus; floppy disk, \$34.95. Columbia Software, POB 2235, Columbia, MD 21045.

Sea Dragon, an arcade-type game. You must navigate the nuclear submarine *Sea Dragon* through a sea filled with deadly obstacles. For the Apple II; floppy disk, \$34.95. Adventure International, POB 3435, Longwood, FL 32750.

Senior Analyst, a modeling program that allows financial planners to analyze and review data. Create models from a common database within the program, or combine many models into one. For the Apple II; floppy disk, \$225. Apple Computer Inc. (see address above).

U.S. Cities, an educational program. Students learn to use a map of the United States. Coordinate locations of major cities are shown on high-resolution displays. For the Apple II Plus; floppy disk, \$25. Island Software (see address above).

Wavy Navy, an arcade-type game. You pilot a PT boat in 30-foot waves while surrounded by enemy planes, helicopters, mines, and missiles. For one to four players. For the Apple II; floppy disk, \$34.95. Sirius Software Inc. (see address above).

Atari

Bulldog Pinball, an arcade-type game. This computer version of a pinball game lets you score points, use flippers, and control ball speed. It features graphics and sound. For the Atari 400/800; cassette, \$29.95. Hayden Software Co., 600 Suffolk St., Lowell, MA 01853.

Castle Wolfenstein, an adventure-type game. You have been captured by Nazis and taken to Castle Wolfenstein for interrogation. You must find the secret war plans and escape. For the Atari 400/800; floppy disk, \$29.95. Muse Software, 347 North Charles

St., Baltimore, MD 21201.

Dragonfire, a video game. Help the prince reclaim the king's treasures. Cross bridges and dodge dragon fire in the quest. For the Atari Video Computer System; cartridge, \$32.95. Imagic, 1875 Dobbin Dr., San Jose, CA 95133.

River Raid, an arcade-type game. You are piloting a B-1 strato-wing assault jet. Your mission is to seek and destroy enemy targets on a dangerous river course. For the Atari Video Computer System; cartridge, \$31.95. Activision Inc., Drawer #7286, Mountain View, CA 94042.

Sea Dragon, an arcade-type game (see description under Apple). For the Atari 400/800; floppy disk, \$34.95. Adventure International, POB 3435, Longwood, FL 32750.

Serpentine, an arcade-type game. You control three blue serpents. Your object is to destroy the hostile orange serpents and create more blue ones. For the Atari 400/800; floppy disk, \$34.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Speed Track, a simulation game. Place your bets, watch six horses race toward the finish line, and collect your winnings. For up to eight players. For the Atari 400/800; cassette, \$19.95. Brenner, POB 459, Plainview, NY 11803.

Stratos, an arcade-type game. One or two players can defend a futuristic city from attack by alien spacecraft. For the Atari 400/800; floppy disk, \$34.95. Adventure International (see address above).

Wayout, an arcade-type game. You have a choice of 26 three-dimensional mazes to explore. Look for the fireflies, but beware of the Cleptangle. Wayout glasses and compass included. For the Atari 400/800; floppy disk, \$39.95. Sirius Software, 10364 Rockingham Dr., Sacramento, CA 95827.

What's New?

megabyte of 5¼-inch floppy-disk storage, 12.5 megabytes of hard-disk storage, a detachable 105-key keyboard with 24 user-definable keys, and a separate monitor and 8086 microprocessor, which operates at 8 MHz. Its internal memory is expandable to 512K bytes, and up to eight PC plug-compatible boards can be added for

peripherals. Additional software available from Eagle includes general accounting, medical and dental practice management, and CPA accounting.

The Model 1630 costs \$6995. Contact Eagle Computer Inc., Building C, 983 University Ave., Los Gatos, CA 95030, (408) 395-5005.

Circle 556 on inquiry card.



Bundle of Software Comes with Business System

The Voyager 4000 series of small business computers comes with the CP/M operating system and word processing, spreadsheet with graphics, database management, mailing list, payroll, Telex, and time management software. The basic Voyager has RS-232C and RS-422A ports, dual 5¼-inch double-sided double-density floppy-disk drives (1.2 megabytes of storage), and an 8085 central processor that addresses 64K bytes of RAM (random-access read/write memory). The central processor is upgradable to 8085/8088-based 8- and 16-bit coprocessor operation, addressing 1000K bytes of RAM. Up to 20 megabytes of plug-in hard-disk storage is available. The series also features an adjustable 12-inch non-glare video monitor with dedicated memory and an 8 by 12 matrix on a 10 by 14 grid with a choice of three colors. The computer's detachable key-

board has 100 five-function keys and a 10-key numeric pad.

The Voyager 4000 costs \$4995, including the software. Dealer and OEM (original equipment manufacturer) discounts are available. Contact Voyager Systems Inc., 2192 Anchor Court, Newbury Park, CA 91320, (213) 991-9028.

Circle 558 on inquiry card.

Atari 1200XL

The Atari 1200XL home computer comes with 64K bytes of RAM (random-access read/write memory), 12 user-programmable function keys, and built-in diagnostics. Its keyboard permits shifting into an integral European character set that includes special currency and character symbols. A Help key is standard as are one-touch cursor controls, 256 available colors for a monitor, and a speaker with 4 voices and a 3½-octave range. The 1200XL is compatible with Atari peripherals and software products.

Options for the 1200XL include a cassette memory system, an 80-column printer, and a 40-column printer/plotter. The mem-

ory system, the Model 1010 Program Recorder, uses standard audio cassettes and features two channels for both a program and sound effects. The Model 1025 printer prints dot-matrix characters at 40 cps (characters per second) and accepts single-sheet, fan-fold, and rolled paper. The Model 1020 Color Printer/Plotter produces four-color text, complex charts, and graphs to any set of X,Y coordinates. Prices range from \$99.95 to \$549. The 1200XL costs less than \$1000. Full details are available from Atari Inc., 1265 Borregas Ave., POB 427, Sunnyvale, CA 94086.

Circle 557 on inquiry card.

Multuser Telesystem Runs Unix III

A Motorola MC68000-based computer running the Unix III operating system is being marketed by Televideo Systems Inc. The Telesystem II supports up to 16 users and offers interface flexibility by means of 15 serial ports, one RS-422A port, a Centronics-compatible parallel port, and bus expansion capabilities. Standard features include 512K bytes of RAM (random-access read/write memory) and an 8-inch 40-



Software Received

Apple

Bolo, an arcade-type game. You must maneuver your tank through the maze to avoid or destroy enemy tank bases. This game features nine levels of play and five maze densities. For the Apple II; floppy disk, \$34.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

Graphical Analysis. With this graphics-utility program, you can plot graphs based on numerical data in high-resolution graphics. This program is designed to be especially useful for science classes. For the Apple II; floppy disk, \$24.95. Vernier Software, 2920 Southwest 89th St., Portland, OR 97225.

Killer T-Cell, an educational-maze game based on biomedical discoveries in cancer research. You control the movements of a T-lymphocyte, a type of white blood cell that destroys cancer cells. All proceeds will fund cancer research at the University of Texas System Cancer Center. For the Apple II; floppy disk, \$20. Killer T-Cell, M. D. Anderson Hospital and Tumor Institute, Texas Medical Center, Box 6, 6723 Bertner Ave., Houston, TX 77030.

LIMITS Programs for Calculus Students, an introductory calculus course that covers the fundamentals of the derivative and integral with graphics, drills, and explanations. For the Apple II Plus; floppy disk, \$65. Dale T. Hoffman, Division of Science and Mathematics, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands 00801.

Math I, a tutorial program

that covers basic mathematical skills up to simple algebra for grades 1 through 8. For the Apple II Plus; floppy disk, \$38. Personal Computer Art, 1007 Far Hills Dr., East Peoria, IL 61611.

Nutritionist. Using interactive graphics, this diet-analysis program helps you develop nutritionally balanced meals and diets for both personal and professional uses. For the Apple II; floppy disk, \$145. N-Squared Computing, 5318 Forest Ridge Rd., Silverton, OR 97381.

Precision Timer. Using auxiliary equipment, this utility program turns the computer into a flexible laboratory timer. Save timing data on disk and analyze it later. For the Apple II; floppy disk, \$39.95. Vernier Software (see address above).

Ray Tracer, a program on the laws of geometrical optics. See how light behaves when you place various interfaces and optical devices on the screen and produce ray diagrams. For the Apple II; floppy disk, \$24.95. Vernier Software (see address above).

Secur-A-Text, a data-encryption/decryption program that prevents files from being loaded into your computer unless you know the master- and local-code key numbers for access. For the Apple II; floppy disk, \$49.95. T & F Software Co., 10902 Riverside Dr., North Hollywood, CA 91602.

Stan, a statistical-analysis system. You can enter data to analyze for variance or regression coefficients and produce a graph. For the Apple II; floppy disk, \$300. Statistical Consultants, Park Plaza Office Bldg., 462 East High St., Lexington, KY 40508.

Taxmode, a tax-planning program. You can compute the components of individual federal income tax liability for the years from 1980 to 1985 according to current tax laws. For the Apple II Plus; floppy disk, \$250. J. P. Sawhney & Co. Inc., 888 Seventh Ave., New York, NY 10106.

Trickster Coyote, an educational word game that will help increase a child's vocabulary. With animations in high-resolution graphics and sound, this program is for four players age 8 and older and includes a built-in dictionary. For the Apple II; floppy disk, \$48.96. Reader's Digest Services Inc., Microcomputer Software Div., Pleasantville, NY 10570.

Word Attack, a four-part educational word-game program helps build vocabulary skills by displaying up to 675 words in illustrative sentences for students age 8 through adult. For the Apple II Plus; floppy disk, \$49.95. Davidson & Associates, 6069 Groveoak Place #12, Rancho Palos Verdes, CA 90274.

Atari

P.M.P. 2000, a property-management program. This program is a template for Visicalc to help you maintain status reports, invoicing, and income/expense schedules on rental properties. For the Atari 800; floppy disk, \$219.95. T & F Software Co., 10902 Riverside Dr., North Hollywood, CA 91602.

Reactor, an arcade-type game. Your ship is trapped in a nuclear reactor. You must bounce dangerous nuclear particles into the control rods to prevent a meltdown of the reactor. For the Atari Video

Game System; cartridge, \$30. Parker Brothers, POB 1012, Beverly, MA 01915.

Slot Trivia, a question-and-answer game. If you can answer a trivia question in one of eleven categories, the slot machine will pay off. For two players. For the Atari 400/800; floppy disk, \$29.95. T & F Software Co. (see address above).

Survival of the Fittest, a strategy game. You and another player design colonies of organisms and fight for resources and space in a struggle for survival. For the Atari 400/800; cartridge, \$39.95. Innovative Design Software Inc., POB 1658, Las Cruces, NM 88004.

CP/M

Buysel, several mathematical-analysis programs. This package is designed to help investors decide what to buy and sell in the stock, commodities, and options markets. For CP/M-based systems; floppy disk, \$125 (Canadian funds). Software City, 35 Downsview Cres., Nepean, Ontario K2G 0A4, Canada.

Calendar/1, a calendar-generation program that lets you print out a personalized calendar displaying your events planned for each day. Formatting commands allow for customized calendar designs. For CP/M-based systems; floppy disk, \$60. Clear Systems, Suite 404, 309 Santa Monica Blvd., Santa Monica, CA 90401.

E/T, a text-oriented screen editor. This program offers all essential editing features. It can be reconfigured for different terminals and automatically backs up your files. For

Book Reviews

6502 Assembly Language Subroutines

Lance Leventhal
and Winthrop Saville
Osborne/McGraw-Hill
Berkeley, CA, 1982
550 pages
softcover, \$15.95

Reviewed by
Paul E. Hoffman
2109 Shattuck Ave.
Berkeley, CA 94704

The title of this excellent book is misleading because it covers almost anything that a programmer would want to know about 6502 assembly language, not just subroutines. It does contain more than 50 well-documented subroutines that can

be used in many applications, but the 150 pages of programming methods, hints, and common errors alone are worth the price of the book.

The authors have written a book that both experienced programmers and relative novices can use. The subroutines they present are clear, concise, and filled with excellent comments. Those who own a computer that runs the 6502 chip (such as the Atari, Apple II, or PET) and an assembler program should find the book particularly valuable.

Leventhal and Saville make learning the 6502 fairly easy, especially for people who are familiar with assembly language on other computers. After describing all of the addressing modes and registers of the 6502, the authors offer

quick ways to implement common features that are found on many other chips. For instance, they present many three- and four-step examples of how to manipulate the registers in a manner similar to that used by many other machines. The discussion of I/O (input/output) handling is one of the best around, and it is relevant to many of the subroutines presented in the second part of the book.

The chapter on common programming errors in particular should be read by professional assembly-language programmers whether or not they use the 6502. The authors' comments on improper use of the bit flags, especially the carry bit, are particularly relevant to 6502 programmers because the 6502 handles flags differently than most processors.

Other interesting features of the first section of the book (we haven't even gotten to the subroutines!) are the discussion of stack handling and the clearest explanation of peripheral chips you're likely to find. The logical structure of the material and the profusion of hints make this section as relevant to experienced programmers as it is to novices.

The second section of the book presents subroutines that are useful whether you're writing a business system or a graphics-based game. Most of the common math functions, such as 16-bit multiplication and division, are covered, and all are supplemented by many multiple-precision routines. All of the standard bit manipulations and byte shifts are also shown.

The authors cover arrays in depth with some very easy-to-understand code. The subroutines they present, such as those for n -dimen-

sional indexing and total-array summation, could save a programmer hours of coding and testing. Like most of the subroutines, the one for array handling is given in both 8-bit and 16-bit versions.

Assembly-language programming books that deal with string handling are hard to find. *6502 Assembly Language Subroutines* contains six examples of string handling, all of which are general enough to cover many applications. Through examples, the authors stress ways to handle strings consistently; they do not fall into the usual trap of treating strings as grouped numbers.

Because many of the 6502 computers currently available were designed years ago, their I/O processing and interrupt handlers are often confusing and sometimes unwieldy. Once you get past the operating system, the ability to handle your own I/O is important. Leventhal and Saville offer many good examples of how to program using your own I/O handling.

The authors cover each subroutine extensively. Even though the code is well documented, the book also provides enough information for most programmers to modify any of the routines to suit their particular programs.

Before discussing each subroutine at length, the authors explain its purpose and how it accomplishes its goal—in plain English. In addition, they offer suggestions about other areas in which the subroutine might be useful and the type of data for which it was intended.

A wealth of other information is given along with the subroutines. The technical considerations that an experienced programmer might have—such as which registers

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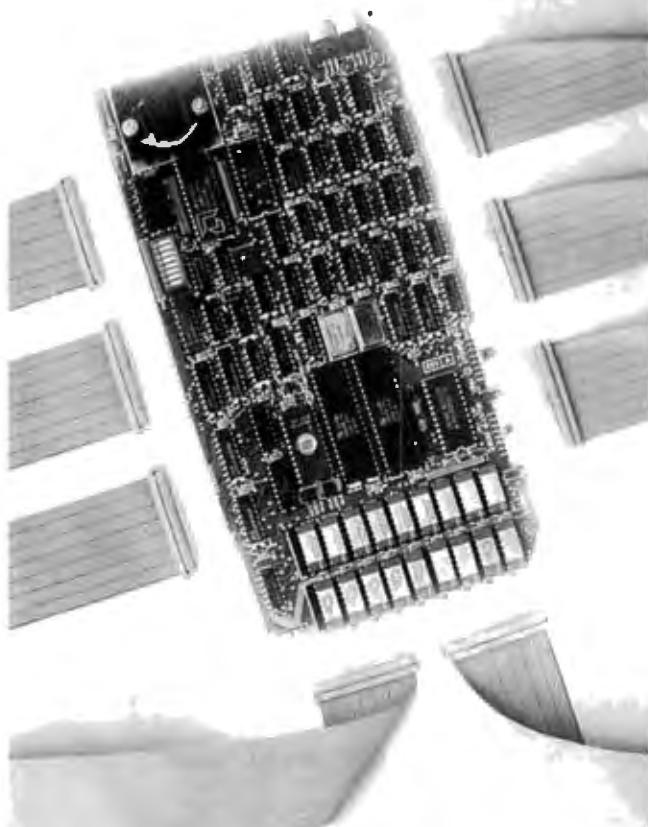
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Book Reviews

are used—are covered concisely. These considerations include the size of the subroutine and the amount of data RAM needed.

The authors should be commended for their decision to include precise calculations for the execution times for each subroutine. Even though assembly-language programs on the 6502 are quite fast, programmers often forget that frequently called subroutines can slow a system down considerably. The authors give equations for determining the number of cycles for all of the given subroutines.

Most of the subroutines presented take all of their arguments from the stack, which makes the calling procedure much more general. An English description of the entry and exit conditions precedes the code. The authors also discuss special cases that you might encounter so that you can test for them before the subroutine is called.

In addition to offering thorough descriptions of everything in the code that they wrote, the authors documented the code completely. Variable names are surprisingly consistent throughout the book, and standard names for memory locations are used whenever possible.

The assembly pseudo-operations the authors use resemble those used on mainframe computers, so programmers shifting down to the microcomputer will feel at home. The authors define the variables on the first page of RAM memory at the beginning of the subroutine but wait until the end of the code to define the position-independent variables.

The authors stress good documentation for all of their code but also conserve space whenever possible. For example, the array-handling

programs do not attempt to make row and column computations if others are more appropriate. The emphasis is on clean code that is easy to understand.

The heavy use of the stack, both for passing the parameters of the subroutine and for processing, makes many of the subroutines easier to understand. Although the 6502's stack is underused by many programmers, the authors' structured style emphasizes saving memory and machine cycles by pushing and popping short-lived variables on the stack.

When handling strings, the authors assume that the programmer knows the length of the string before the subroutine is called. This is often true when you're writing assembly-language programs that interface with BASIC, but it may not always be true otherwise. The lack of routines for handling floating-point numbers is also unfortunate because most BASIC languages deal almost exclusively with them. Still, the general nature of the subroutines that are given lets programmers preformat the data that is being passed.

6502 Assembly Language Subroutines is exceptionally complete in its presentation of subroutines and should be an indispensable reference for programmers. The explanations that go along with the subroutines are clearly written and contain almost all of the information that could be relevant to modifying the authors' code to fit a particular need.

The first part of the book is one of the best references about the 6502 on the market. It shows how to easily overcome most of the weaknesses in assembly language and how to prevent programming mistakes. Together, the two sections form a superior programming manual. ■

The I/O ports do not have a standard location; they are a function of how the memory is configured. A 1K-byte block could be set aside to handle I/O, so it's not necessary to use a coprocessor for the task (I detect by your comments that you are a seasoned Z80 user). Memory-mapping I/O is convenient, fast, and easy to use.

The reason you haven't seen much 68000 software around is that the chip is just beginning to get popular. However, a listing of small-business computers in the June 1982 issue of *Mini-Micro Systems*, "Small-Business Systems Solve Big Problems," by David Simpson (page 201), indicated a preference for Unix or Unix-like operating systems (such as Microsoft's Xenix).

The thought of writing your own operating system is ambitious, and compatibility with other software is important. You might want to consider Digital Research's version of CP/M for the 68000. Most of this software is for the business and industrial markets and is quite expensive. . . . Steve

Quick Printer Interface

Dear Steve,

I would like to interface a Radio Shack Quick Printer II to an Atari 400. I would appreciate any help that you could give me.

Thank you.
Gary Greaser
Silverdale, WA

The Radio Shack Quick Printer II requires serial data input at 600 bps (bits per second). It has a built-in microprocessor to convert the incoming data to a 7-bit ASCII code. Only three lines are needed: Data, Ground, and a Clear-to-Send signal for handshaking.

The interface to the Atari 400 is a little more difficult. While the Atari 400 does produce serial data, it is at a high rate (i.e., in excess of 19,000 bps), and it's not RS-232C-compatible. It is conceivable that you could build an adapter specifically for this project, but it is far more reasonable to buy Atari's Model 850 expansion box. This unit adds one parallel port and four serial ports to an Atari 400/800. It costs about \$150. . . . Steve

Printer Drops Characters

Dear Steve,

I have an Explorer 85 computer and the Heath H14 printer. When I Run or List a program, the printer loses characters after several lines. Do you have a circuit of a printing buffer that would hold several K bytes' worth of characters and let the printer catch up with the flow of data?

I purchased a surplus memory board with sixty-four 2102-type static memories; could it be used in the circuit?
Leroy W. Marshall
Schaumburg, IL

If your printer loses data after printing several lines, it is an indication that handshaking between the printer and the computer is not occurring. Handshaking is the means of telling the computer to send data only when the printer is ready to accept it. Adding a buffer will only postpone the problem, since data loss will occur after the buffer is full.

The solution is to check the handshaking signals between the computer and the printer. For a serial port, the signals are Request-to-Send (RTS) and Clear-to-Send (CTS). For a parallel port, the signals are Acknowledge (ACK), Data Accepted, or something

similar. When these are properly connected, the flow of data from the computer will stop until the printer can catch up. This method is also much simpler than adding a buffer to the printer. For an idea of how RS-232C interfaces work, you may want to refer to Ian H. Witten's "Welcome to the Standards Jungle" (February 1983 *BYTE*, page 146). . . . Steve

Parts Located

Dear Steve,

I want to build my own personal computer (perhaps several) from the ground up so that I can learn about computers. I have a book by Charles Adams that gives plans for a computer, but I cannot find two parts that he specifies: 7093-type integrated circuits and an 8½-by 16-inch Vector board. Do you know where I can find them?

R. C. Coakley
Flandreau, SD

The 7093 chips referred to in Charles Adams's book, *How to Build Your Own Working Computer* (Blue Ridge Summit, PA: Tab Books, 1979), are known as Tri-State (three-state) Quad Buffers and are made by National Semiconductor. They are equivalent to the DM8093 or the more common 74LS125. The latter is a pin-compatible replacement and is available from any of the mail-order houses that advertise in *BYTE*, such as Advanced Computer Products, Jade Computer Products, and Jameco Electronics.

The Vector board is made by Vector Electronic Company (12460 Gladstone Ave., Sylmar, CA 91342) and is available in a variety of styles and materials (I prefer the epoxy glass). It consists of holes spaced at intervals of ½ inch on center in both direc-

tions. The model number for the 8½-by 17-inch board is 169P84. Vector boards can usually be obtained from the above mail-order sources. . . . Steve

Information on NASA's Videodiscs

Dear Steve,

I am most interested in your article "Build an Interactive-Videodisc Controller" (June 1982 *BYTE*, page 60). The text box accompanying it mentioned that NASA was producing videodiscs for distribution sometime in the near future. Do you have any further information?

Thank you.
R. Teakes
Toronto, Ontario, Canada

For further information, write to the Jet Propulsion Laboratory, Planetary Image Facility, 4800 Oak Grove Dr., Pasadena, CA 91103, Attn: Mr. Michael Martin, Planetary Data Management Team. . . . Steve ■

In "Ask *BYTE*," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

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POB 582
Glastonbury CT 06033

If you are a subscriber to *The Source*, chat with Steve (TEC317) directly. Due to the high volume of inquiries, personal replies cannot be given. Be sure to include "Ask *BYTE*" in the address.

Software Received

Apple

Concentrated Chemical Concepts. This introductory chemistry course for high school students is available as a whole or in parts: general, organic, and biological chemistry. For the Apple II; floppy disk, \$550. Wiley Educational Software, John Wiley & Sons, 605 Third Ave., New York, NY 10158.

Correlated Samples, an educational program designed to teach difficult concepts in elementary statistics to high school and undergraduate students. For the Apple II; floppy disk, \$75. HMS Software, POB 49186, Austin, TX 78765.

Dow Jones News and Quotes Reporter, a database information service. You can access the Dow Jones online database to receive current information on stocks and securities from *The Wall Street Journal*, *Barron's*, and the Dow Jones News/Retrieval Service. For the Apple II Plus; floppy disk, \$135. Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014.

Econalysys. This economic-forecaster program helps you determine the best of several possible investments by comparing the costs of any energy- or maintenance-intensive purchase in six ways. For the Apple IIe; floppy disk, \$100. Energy Software, 1403 South 7th Ave., Kelso, WA 98626.

Family Roots 1.2, a set of programs that assist you in your search for family historical information. You can edit, search, file, chart, print, and further organize family data. For the Apple IIe; floppy disk, \$185.

Quinsept Inc., POB 216, Lexington, MA 02173.

Health-Aide, a nutritional, diet, and personal data system designed to provide a comprehensive analysis of your health. For the Apple II; floppy disk, \$79.95. Knossos Inc., 422 Redwood Ave., Corte Madera, CA 94925.

Laser Bounce, an arcade-type game. You must destroy enemy energy modules by bouncing laser beams off moving satellites and defend your own modules from the same attack. For the Apple II; floppy disk, \$34.95. Hayden Software Co., 600 Suffolk St., Lowell, MA 01853.

Old Ironsides, a naval-battle game. As animated ships fire at each other, two players can either shoot out each other's ammunition or hide in the fog and contend with the wind. For the Apple II; floppy disk, \$39.95. Xerox Education Publications, Computer Software Division, 245 Long Hill Rd., Middletown, CT 06457.

Pick That Tune, a musical-identification game. See if you can identify a song after hearing only a few notes. One to ten players can move through sixteen levels of difficulty. For the Apple II; floppy disk, \$29.95. Swearingen Software, Suite 197, 6312 West Little York, Houston, TX 77088.

Pinball Construction Set, a video-construction set. You can design and build your own high-resolution pinball games using video tools and parts to make borders and obstacles. For the Apple II; floppy disk, \$39.95. Budge Co. Inc., 428 Pala Ave., Piedmont, CA 94611.

Stickybear ABC, an educa-

tional program. Colorful animations help children between the ages of 3 and 6 to learn each letter of the alphabet. For the Apple II; floppy disk, \$39.95. Xerox Education Publications (see address above).

Stickybear Bop, a game for the whole family. In this animated shooting gallery see if you can knock ducks, planets, balloons, and Stickybears off the screen. For the Apple II; floppy disk, \$39.95. Xerox Education Publications (see address above).

Stickybear Numbers, an educational program. Colorful objects that move across the screen help children learn numbers and counting skills. For the Apple II; floppy disk, \$39.95. Xerox Education Publications (see address above).

Zipscript, a word-processing system. This line-oriented text editor provides more than 65 editing and formatting commands. It is suitable for building data files and editing BASIC programs. For the Apple II Plus; floppy disk, \$49.95. Carter-mation, 3245 Pursell Dr., Pensacola, FL 32506.

Atari

Jumbo Jet Pilot, a flight-simulation game. Put yourself in the pilot's seat, maneuver your way through the clouds to a safe landing, and receive a performance rating. Ten game variations; requires a joystick. For the Atari 400/800; cartridge, \$49.95. Thorn EMI, 1370 Avenue of the Americas, New York, NY 10019.

The Magic Melody Box. This educational program lets you

learn to create music simply by drawing a line. See and hear the computer harmonize your rhythm and melody in a song. Requires a joystick. For the Atari 400/800; floppy disk, \$15.95. Atari Program Exchange, 3281 Scott Blvd., POB 3705, Santa Clara, CA 95055.

Soccer, a soccer-animation game. Try to score a goal as you dribble the ball down the field. Features include goals, lines, a time clock, and 200 variations. Requires one to four joysticks. For the Atari 400/800; cartridge, \$49.95. Thorn EMI (see address above).

Submarine Commander, a submarine-patrol game. Your submarine must attack and destroy the enemy merchant-shipping boats in the Mediterranean. Requires one joystick. For the Atari 400/800; cartridge, \$49.95. Thorn EMI (see address above).

CP/M

TCS Simple. This information-filing system allows you to store, query, and generate reports from database files. It can also create record types for logical organization of data. This utility package is designed to be used in conjunction with the TCS Total Accounting System. For CP/M 2.2-based systems, floppy disk. Price not available. TSC Software, 3209 Fondren Rd., Houston, TX 77063.

Z80 DIS. This disassembler package for Z80-based CP/M systems takes binary information from a disk file and converts it to either a source file or a listing file. For CP/M-based systems; floppy disk, \$69.95. SLR Systems,

BYTE

Game Contest #2

After reviewing the 77 entries we received for the second BYTE game contest, we think it's safe to draw the inference that Apple owners are enthusiastic game players. Of the total number of entries, 26 were written for the Apple II. The remaining two-thirds break down this way: 16 for the TRS-80 Color Computer, 10 for the IBM Personal Computer, and the other 25 are divided among the TRS-80 Models I, II, and III, the Commodore VIC-20, and the Atari 400 and 800.

We will have a pictorial essay on the winning games in the September 1983 issue of BYTE. It will include details on ordering selected games in disk format. Look for us then.

Given the preponderance of Apple-based entries, it should come as no surprise that the majority of the winning games are for the Apple II. Here are this year's winners:

Second place (\$300 and a jacket) goes to Shawn Day of British Columbia for a simple but professional-looking Apple assembly-language arcade game called Sizzle. As alien invaders drop to the ground, you push a barbecue cart across the bottom of the screen trying to catch as many as possible. Other factors complicate the game.

Fourth Place (\$100 and a jacket) goes to C. Anthony Ray of Urbana, IL, (second-place winner of last year's contest) for an interesting arcade-type Apple II game called It's the Pits. You maneuver an animated Grimpit through a maze in search of nutritious yumyums. Several complications make the game more interesting; one such complication is that the maze "walls" are actually pits—one false move, and you've "killed" one of your three Grimpits.

First place (\$500 cash prize plus a custom BYTE jacket) goes to Aaron Pratt of Ypsilanti, MI, for his two-player two-computer tank warfare game called Dual Duel. Reminiscent of the Atari arcade game Battlezone, it places you inside a tank driving around a plain containing several obstacles such as two pyramids and two blocks, and an enemy tank. As you move, the three-dimensional scenery changes in real time. The object of the game is to be the first to "kill" the enemy tank 10 times; it runs on two Apple IIs, two Atari 800s, or one of each.

Third place (\$150 and a jacket) goes to William P. Porter of Coral Springs, FL, for his TRS-80 Model I game, Juggle. Playing against yourself in real time, you try to keep as many video "balls" as possible in the air at one time.

Fifth place (\$100 and a jacket) goes to William Hubbard of Tuscon, AZ, who wrote an Apple-soft strategy game for the Apple II called Rescue. To play, you fly a rescue helicopter over islands in the Pacific Ocean in search of stranded ocean-liner passengers.

Control Your Environment with the Atari 400/800

A combination of hardware and software enables your computer to monitor and influence your surroundings.

by David Alan Hayes

Imagine that your computer turns on the lights and flashes a welcoming message on its display screen the instant you walk into a room. It's not a far-off possibility. With the right equipment, your Atari 400 or 800 can sense your (or anyone's) presence and control AC-powered devices such as lamps, household appliances, and even burglar alarms.

Some Software Techniques

A great deal of information can be determined about the world by sim-

ply monitoring switches. An open switch on a window could indicate that a thief is entering your home. A closed switch might indicate that someone is standing on a concealed switch mat (like those at supermarket exits). Wouldn't it be nice if a lamp came on automatically if a light-sensitive switch indicated that room lighting was too dim? An electronic sound switch could monitor a sleeping baby. If you do the work yourself, you can install an elaborate system of switches throughout your home for a few hundred dollars. You can then turn your Atari computer into a powerful energy-management and burglar-alarm system. All of this can be done through the peripheral interface adapter (PIA) in your Atari computer.

The PIA (figure 1) is a large-scale integrated circuit whose primary function in the Atari is to link the joystick to the computer. It monitors the four normally open switches that indicate the direction the joystick has been tilted (see figure 2 and listing 1).

The PIA monitors the joysticks input via two 8-bit ports labeled PORTA and PORTB. Because these ports are bidirectional, they can also be used to set switches. PORTA and PORTB can be reset as outputs easily

via the PIA's two 8-bit data-direction registers (DDRA and DDRB). Placing a 0 in a bit position in DDRA or DDRB causes the corresponding controller jack pin to act as an input; a 1 causes it to act as an output (figure 2).

DDRA has the same address as PORTA (hexadecimal D300, decimal 54016). Similarly, DDRB has the same address as PORTB (hexadecimal D301, decimal 54017). Therefore, a control program has to tell the PIA which register it wishes to address before addressing 54016 or 54017. The program can do this by using two

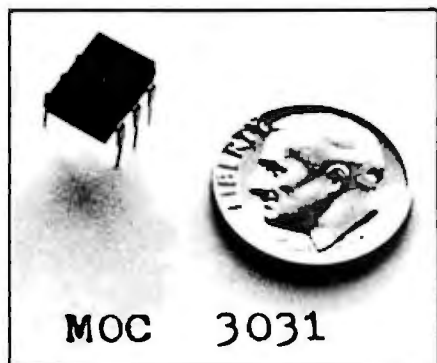


Photo 1: The MOC3031 is the heart and brains of the solid-state relay described in the text. Don't let its small size fool you; it can protect a computer from voltage spikes up to 7500 V. It costs about \$2 from any Motorola distributor.

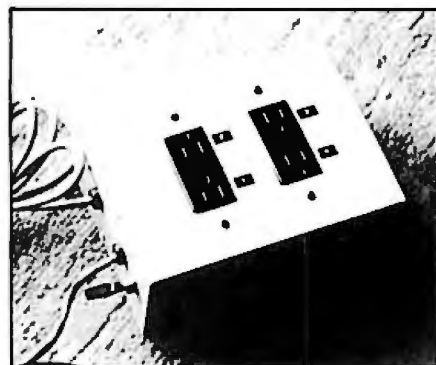


Photo 2: The chassis of the four-channel SSR prototype the author built contains a control cable, which plugs into any Atari 400/800 controller jack and a power cord.

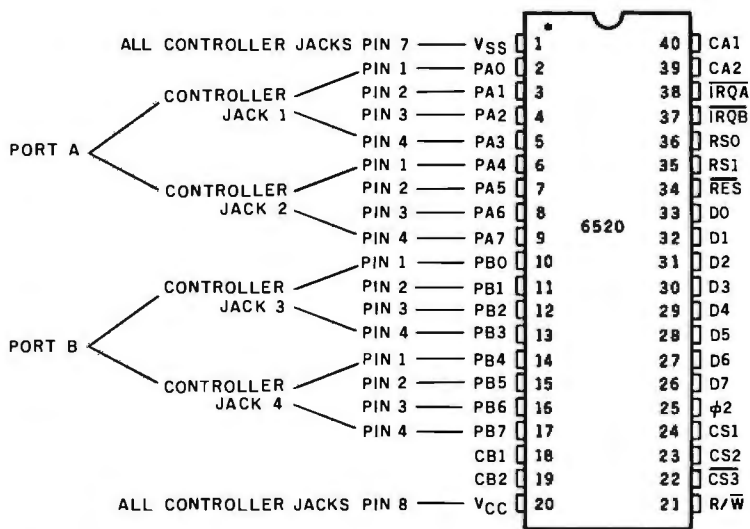


Figure 1: The peripheral interface adapter. Pins 2 through 17 connect indirectly through a 220-ohm resistor to the controller jack pins shown. These pins can be used as input or output.

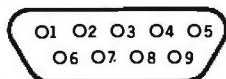


Figure 2a: Subminiature D-type jack on Atari chassis for joystick.

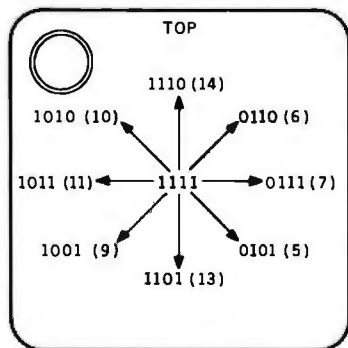


Figure 2b: Joystick positions and their corresponding digital codes (decimal value in parentheses).

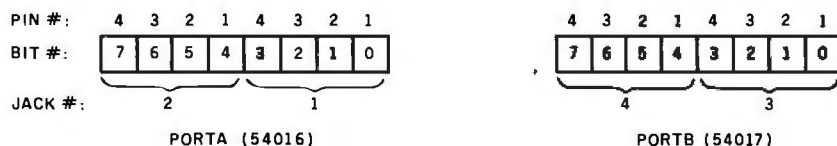


Figure 2c: I/O ports used to access joysticks.

other 8-bit registers called Port A Control (PACTL, 54018) and Port B Control (PBCTL, 54019). Setting bit 2 of these registers to 1 causes the computer to address PORTA or PORTB. All other bits of PACTL and PBCTL should be left as the operating system set them up. Listing 2 demonstrates how to set up pins 1 through 4 of controller jack 1 (farthest left) as an output. These pins can control up to four solid-state relays. It also sets up pins 1 through 4 of controller jacks 2, 3, and 4 as inputs to monitor up to 12 switches.

The Hardware Problem

How can a computer, which operates on little power, control the raw energy from electrical outlets without endangering people and machines? An integrated circuit (IC) called an optoisolator offers a surprisingly simple and inexpensive solution. The IC is so named because its input is electrically isolated from its output. This circuit uses low-level computer signals to drive an LED (light-emitting diode) that in turn controls a solid-state relay (triac).

Motorola has developed an optoisolator, called the MOC3031, that will protect a computer from power-line transients as high as 7500 volts (V). In addition, the MOC3031 has a zero-crossing switch that switches power on or off only when the power-line voltage is at ground potential (figure 3). This prevents the electromagnetic interference (EMI) that usually occurs whenever electrical power is turned on or off rapidly. EMI can cause snow-storm effects on a video screen and popping sounds from speakers. It may even cause your computer to malfunction.

Figure 4 shows a typical solid-state relay circuit employing an MOC3031. You should consider three important specifications when selecting a triac for the circuit (see table 1). The repetitive peak off-state voltage (V_{DROM}) specifies the amount of voltage that the triac will block when switched off. For home power control, V_{DROM} must be greater than 200 V.

The triac's on-state RMS (root mean square) current (I_O) specifies the

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Listing 1: This program reads the joystick controller jacks directly through the PIA.

```
0 REM LISTING 1
10 DIM DIRECTION$(2):REM DIMENSION STRING
20 REM PIA READ DEMONSTRATION
25 REM USING JOYSTICK.
30 REM YOU CAN SAVE SOME TYPING IF YOU
40 REM LEAVE OUT THE REM COMMENTS.
50 ? " ":REM CLEAR SCREEN
60 PACTL=54018:REM PORT A (JS PORTS 1 & 2, PINS 1-4) CONTROL REGISTER.
70 PBCTL=54019:REM PORT B (JS PORTS 3 & 4, PINS 1-4) CONTROL REGISTER.
80 PORTA=54016:REM PORT A I/O REGISTER
90 PORTB=54017:REM PORT B I/O REGISTER
100 DDRA=PORTA:REM 0=INPUT, 1=OUTPUT FOR EACH OF EIGHT BITS IN PORT A.
110 DDRB=PORTB:REM 0=INPUT, 1=OUTPUT FOR EACH OF EIGHT BITS IN PORT B.
115 ? "OS INITIALIZED VALUES":?
120 ? "PACTL= ";PEEK(PACTL):REM PRINT START VALUE FOR PACTL
130 ? "PBCTL= ";PEEK(PBCTL):REM PRINT START VALUE FOR PBCTL
140 POKE PACTL,56:REM ALLOWS DDRA TO BE ADDRESSED SINCE BIT 2 = 0
150 ? "DDRA= ";PEEK(DDRA):REM PRINT START VALUE FOR DDRA
160 POKE PACTL,60:REM SET PACTL BACK TO START VALUE
170 POKE PBCTL,56:REM ALLOWS DDRB TO BE ADDRESSED SINCE BIT 2 = 0
180 ? "DDR= ";PEEK(DDR):REM PRINT START VALUE FOR DDR
190 POKE PBCTL,60:REM SET PBCTL BACK TO START VALUE
200 ? "NOTICE THAT BOTH DDRA/B ARE ZERO":? "(THIS MEANS THAT ALL PINS ARE SETUP AS INPUT BY THE OS.)"
210 ? :? " USE ONLY ONE JOYSTICK"
215 OLDSTICKA=-1:OLDSTICKB=-1:REM SET UP DUMMY VARIABLES
220 FINDSTICKA=230:REM INITIALIZE LINENUMBER VARIABLE
230 STICKA=PEEK(PORTA):REM GET VALUE AT PORT A FROM PIA
240 IF STICKA=OLDSTICKA THEN GOTO FINDSTICKA:REM GET STICKA VALUE UNTIL STICKA VALUE CHANGES
250 FINDPORT=1000:REM FIND PORT SUBROUTINE NUMBER
260 IF STICKA<255 THEN GOSUB FINDPORT:REM FIND THE INPUT PORT # IF STICKA INPUT FOUND
270 FINDDIRECTION=2000:REM FIND DIRECTION OF JS TILT SUBROUTINE LINE NUMBER
280 IF STICKA<255 THEN GOSUB FINDDIRECTION:REM FIND DIRECTION OF JS TILT IF STICKA INPUT FOUND
290 FINDSTICKB=340:REM INITIALIZE FINDSTICKB LINE NUMBER VARIABLE
295 OLDSTICKA=STICKA:REM SET UP OLD STICKA VALUE
300 IF STICKA<255 THEN OLDSTICKA=-1:GOTO FINDSTICKB:REM CHECK PORT B INPUT
310 ? :? "PORTA = ";STICKA,"JS PORT # ";PORT,"DIRECTION IS ";DIRECTION$:REM PRINT INFORMATION FROM PIA
320 OLDSTICKA=STICKA:REM OLD STICK WILL BE USED TO SEE IF STICKA INPUT HAS CHANGED
330 GOTO FINDSTICKA
340 STICKB=PEEK(PORTB):REM GET VALUE AT PORT B FROM PIA
350 IF STICKB=OLDSTICKB THEN GOTO FINDSTICKB:REM GET STICKB VALUE UNTIL STICKB VALUE CHANGES
360 FINDPORT=1000:REM FIND PORT # SUBROUTINE NUMBER
370 IF STICKB<255 THEN GOSUB FINDPORT:REM FIND INPUT PORT # IF STICKB INPUT FOUND
380 FINDDIRECTION=2000:REM FIND DIRECTION OF JS TILT SUBROUTINE NUMBER
390 IF STICKB<255 THEN GOSUB FINDDIRECTION:REM FIND DIRECTION OF JS TILT IF STICKB INPUT FOUND
400 OLDSTICKB=STICKB:REM OLD STICK WILL BE USED TO SEE IF STICKB INPUT HAS CHANGED
410 IF STICKB<255 THEN OLDSTICKB=-1:GOTO FINDSTICKA:REM CHECK INPUT AT STICKA
430 ? :? "PORTB = ";STICKB,"JS PORT # ";PORT,"DIRECTION IS ";DIRECTION$:REM PRINT INFORMATION FROM PIA
440 GOTO FINDSTICKB
1000 REM FIND PORT #
1010 IF STICKA<255 AND STICKA<240 THEN PORT=1:REM IF ANY OF LOW NIBBLE BITS IN STICKA ARE 0 THEN PORT 1 HAS INPUT
1020 IF STICKA<240 THEN PORT=2:REM IF ANY OF HIGH NIBBLE BITS OF STICKA ARE 0 THEN PORT 2 HAS INPUT
1030 IF STICKB<255 AND STICKB<240 THEN PORT=3:REM IF ANY OF LOW NIBBLE BITS IN STICKB ARE 0 THEN PORT 3 HAS INPUT
1040 IF STICKB<240 THEN PORT=4:REM IF ANY OF HIGH NIBBLE BITS OF STICKB ARE 0 THEN PORT 4 HAS INPUT
1050 RETURN
2000 REM FIND DIRECTION OF JS TILT (ALL NUMBERS ARE IN DECIMAL)
2010 IF PORT=1 OR PORT=3 THEN 2500:REM GOTO LOW NIBBLE CHECK
2020 REM HIGH NIBBLE CHECK
2030 IF STICKA=239 OR STICKB=239 THEN DIRECTION$="N":REM 239 IS NORTH TILT
2040 IF STICKA=223 OR STICKB=223 THEN DIRECTION$="S":REM 223 IS SOUTH TILT
2050 IF STICKA=191 OR STICKB=191 THEN DIRECTION$="W":REM 191 IS WEST TILT
2060 IF STICKA=127 OR STICKB=127 THEN DIRECTION$="E":REM 127 IS EAST TILT
2070 IF STICKA=175 OR STICKB=175 THEN DIRECTION$="NW":REM 175 IS NW TILT
2080 IF STICKA=159 OR STICKB=159 THEN DIRECTION$="SW":REM 159 IS SW TILT
2090 IF STICKA=111 OR STICKB=111 THEN DIRECTION$="NE":REM 111 IS NE TILT
2100 IF STICKA=95 OR STICKB=95 THEN DIRECTION$="SE":REM 95 IS SE TILT
2110 RETURN
2500 REM LOW NIBBLE CHECK
2510 IF STICKA=254 OR STICKB=254 THEN DIRECTION$="N":REM 254 IS NORTH TILT
2520 IF STICKA=253 OR STICKB=253 THEN DIRECTION$="S":REM 253 IS SOUTH TILT
2530 IF STICKA=251 OR STICKB=251 THEN DIRECTION$="W":REM 251 IS WEST TILT
2540 IF STICKA=247 OR STICKB=247 THEN DIRECTION$="E":REM 247 IS EAST TILT
2550 IF STICKA=250 OR STICKB=250 THEN DIRECTION$="NW":REM 250 IS NW TILT
2560 IF STICKA=249 OR STICKB=249 THEN DIRECTION$="SW":REM 249 IS SW TILT
2570 IF STICKA=246 OR STICKB=246 THEN DIRECTION$="NE":REM 246 IS NE TILT
2580 IF STICKA=245 OR STICKB=245 THEN DIRECTION$="SE":REM 245 IS SE TILT
2590 RETURN
```

Circle 304 on Inquiry card. ➡

Listing 2: This program sets up controller jack 1 (farthest left) as an output jack and the others as input jacks.

```
0 REM LISTING 2
1 DIM A$(3)
10 FOR ADDRESS=1536 TO 1571:READ INSTRUCTION:POKE ADDRESS,INSTRUCTION:NEXT ADDRESS
20 DATA 104,104,133,205,104,133,204,104,5,205,133,213,104,5,204,133,212,96
25 REM LOGICAL OR ROUTINE (1536)
30 DATA 104,104,133,205,104,133,204,104,37,205,133,213,104,37,204,133,212,96
35 REM LOGICAL AND ROUTINE (1554)
40 FACTL=54018:PORTA=54016:PORTB=54017:REM ASSIGN ADDRESS NUMBERS
50 POKE FACTL,56:POKE PORTA,15:REM SET UP CONTROLLER JACK #1 (CJ1) AS OUTPUT, DDR
  A = 00001111
55 REM DDRB IS SET UP AS 0, 00000000 (ALL INPUT) BY THE OPERATING SYSTEM
60 POKE FACTL,60:REM ALLOW PORTA TO BE ADDRESSED
70 POKE PORTA,0:REM SET OUTPUT (CJ1, PIN 1-4) TO ZERO
80 REM INITIALIZATION COMPLETE
90 ? " "
100 POSITION 8,5
110 ? "CONTROLLER JACK MENU":? :?
120 ? "      1) JACK 1":?
130 ? "      2) JACK 2":?
140 ? "      3) JACK 3":?
150 ? "      4) JACK 4":?
160 TRAP 400:?:? :? :? "      WHICH JACK":INPUT JACKNUM
170 IF JACKNUM<1 OR JACKNUM>4 THEN 400
180 IF JACKNUM=1 THEN ? :? :? "CONTROLLER JACK #1 IS THE OUTPUT JACK.":GOTO 190
185 GOTO 290
190 GOSUB 1000
210 ? :? "      OUTPUT MENU"
220 ? :? "      1) PIN 1 HIGH      5) PIN 1 LOW"
230 ? :? "      2) PIN 2 HIGH      6) PIN 2 LOW"
240 ? :? "      3) PIN 3 HIGH      7) PIN 3 LOW"
250 ? :? "      4) PIN 4 HIGH      8) PIN 4 LOW"
260 ? :? :? :? :? "      SELECT OPTION":TRAP 400:INPUT ANS
270 IF ANS<1 OR ANS>8 THEN 400
280 ON ANS GOSUB 500,550,600,650,700,750,800,850
285 POSITION 0,3
285 GOSUB 1000
288 FOR WT=0 TO 1500:NEXT WT:GOTO 90
290 ? " "
300 POSITION 2,7:?:? "CONTROLLER JACK #";JACKNUM:" IS AN INPUT JACK."
310 IF JACKNUM=2 THEN JACKVAL=USR(1554,PEEK(PORTA),240):GOTO 320:REM 11110000 AND
  D XXXXXXXX = JACKVAL = XXXX0000
315 GOTO 340
320 ? :? "THE VALUE AT JACK #";JACKNUM:" IS ";JACKVAL
330 GOTO 385
340 IF JACKNUM=3 THEN JACKVAL=USR(1554,PEEK(PORTB),15):GOTO 320:REM JACKVAL = 00
  00XXXX
370 JACKVAL=USR(1554,PEEK(PORTB),240):GOTO 320:REM JACKVAL = XXXX0000
385 ? :? :? :? :? "      TO CONTINUE PRESS RETURN ":TRAP 90:INPUT DUMMY
390 GOTO 90
400 ? " "
410 POSITION 12,12
420 ? "WHAT'S WRONG"
430 FOR WT=0 TO 500:NEXT WT
440 GOTO 90
500 REM TURN PIN ONE ON (HIGH)
510 VAL=USR(1536,PEEK(PORTA),1)
520 POKE PORTA,VAL
530 RETURN
550 REM TURN PIN TWO ON (HIGH)
560 VAL=USR(1536,PEEK(PORTA),2)
570 POKE PORTA,VAL
580 RETURN
600 REM TURN PIN THREE ON (HIGH)
610 VAL=USR(1536,PEEK(PORTA),4)
620 POKE PORTA,VAL
630 RETURN
650 REM TURN PIN FOUR ON (HIGH)
660 VAL=USR(1536,PEEK(PORTA),8)
670 POKE PORTA,VAL
680 RETURN
700 REM TURN PIN ONE OFF (LOW)
710 VAL=USR(1554,PEEK(PORTA),254)
720 POKE PORTA,VAL
730 RETURN
750 REM TURN PIN TWO OFF (LOW)
760 VAL=USR(1554,PEEK(PORTA),253)
770 POKE PORTA,VAL
780 RETURN
800 REM TURN PIN THREE OFF (LOW)
810 VAL=USR(1554,PEEK(PORTA),251)
820 POKE PORTA,VAL
830 RETURN
850 REM TURN PIN FOUR OFF (LOW)
860 VAL=USR(1554,PEEK(PORTA),247)
870 POKE PORTA,VAL
880 RETURN
1000 JACK1VAL=USR(1554,PEEK(PORTA),15):REM 00001111 AND XXXXXXXX = JACK1VAL = 00
  00XXXX
1010 ? :? "THE PRESENT VALUE AT CONTROLLER JACK #1 IS ";JACK1VAL
1020 RETURN
```

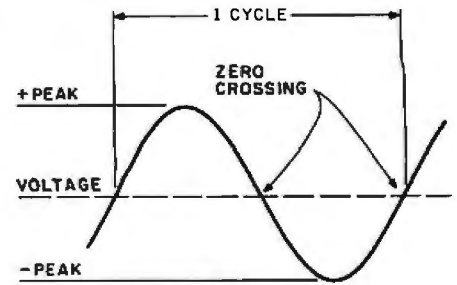


Figure 3: Switching power on and off at the zero-crossing points of the AC cycle. The circuit shown in figure 4 uses this technique to prevent production of electromagnetic interference.

amount of current that can flow through the triac. Usually I_O is determined by the manufacturer at near ideal conditions. Therefore, I_O should not be exceeded unless you use a Sherman tank as a heat sink. I_O must be greater than the expected load current. Keep in mind that your home's circuit breakers will blow when load currents exceed about 20 amps (A).

The triac's gate turn-on current (I_{GTO}) specifies the amount of gate current required to turn on the triac. The I_{GTO} must be less than 0.1 A to work with the MOC3031.

All power triacs should be mounted on heat sinks for best results. The metal case of a power triac is usually one of its main power terminals also. Therefore, the triac and its heat sink must be electrically insulated from all other hardware to prevent short circuits.

Resistor R1 in figure 4 allows about 18 milliamps (mA) to flow into pin 1 of the MOC3031. This current energizes an infrared diode, which in turn activates the triac driver inside the MOC 3031. The TTL (transistor-transistor logic) levels in an Atari's controller jacks will not provide the 18 mA needed, so the 7400 NAND gate (IC1) acts as a current buffer. Switch S1 allows you to disconnect the computer from the relay circuit as a safety measure (see photo 2).

The value of resistor R2 will vary depending on the I_{GTO} of T1 and the desired turn-on voltage. Table 1 lists the value in ohms (Ω) of R2 for several solid-state relays.

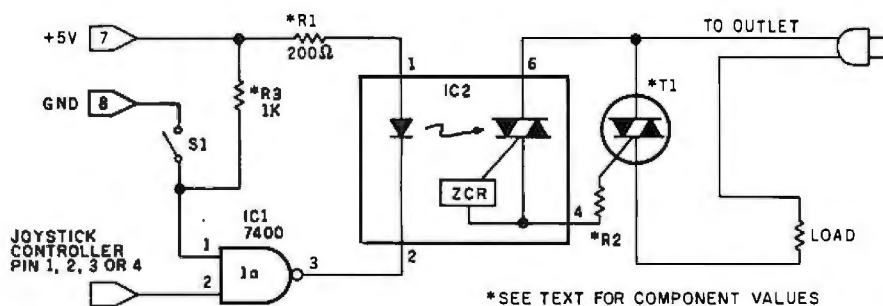


Figure 4: This solid-state relay isolates a computer from up to 7500 V, produces no EMI when switching, runs quietly because it has no moving parts, and connects directly to an Atari 400/800.

Triac	V _{DROM}	I _O	Typical I _{GTO}	Maximum Power Delivered P = V _{I_O}	R2
Motorola SC 245B	200 V	10 A	25 mA	1200 W	600 Ω
Radio Shack 276-1001	200 V	6 A	50 mA	700 W	300 Ω
276-1000	400 V	6 A	50 mA	700 W	300 Ω
RCA T2700B	200 V	6 A	15 mA	700 W	1000 Ω
Texas Instruments TIC-246B	200 V	15 A	50 mA	1800 W	300 Ω

Table 1: Some common triacs and their specifications.

Power and Corruption

This circuit has two limits to the amount of power it can control—the I_O of the triac (see table 1 for maximum triac currents, and hence the

maximum power that can be delivered) and the amount of power an outlet can deliver. The current rating of most outlets is 15 A. Therefore, the maximum safe power delivered from

your receptacle (calculated as V × A or 120 × 15) is 1800 watts.

Building the Future

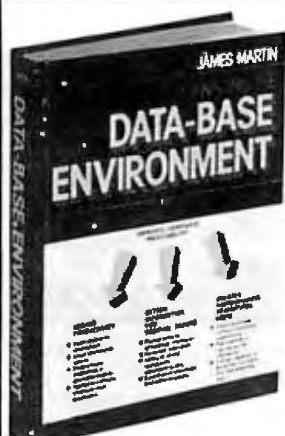
Here are some suggestions for those of you who build this circuit. Make sure you build it exactly as shown in figure 4. If necessary, find someone who can help you. *Do not* connect pins 3 and 5 of the MOC3031 to anything. Remember you are dealing with lethal voltages, so be careful.

Your Atari computer can do a lot more than play games. You can control and monitor the environment to the limits of your imagination. I recommend that you experiment with the hardware and software presented here and build your own custom system. ■

The MOC3031 optoisolator can be purchased from any Motorola distributor, such as Hall-Mark Electronics or Hamilton/Avnet. Their price for small quantities is about \$2 each. If you wish to order by phone, call (800) 555-1212 and ask for the 800 number of the nearest Hall-Mark or Hamilton/Avnet distributor.

* * *

The author will supply a cassette or disk with the programs listed in this article plus a universal output controller program if you send your name and address with \$8 for cassette or \$9 for disk to David Alan Hayes, 3205 Lewisburg Dr., Huntsville, AL 35810. An instruction sheet will be included.



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Software Received

Apple

Address/Dialer, an address, phone-number, and appointment-management program that automatically dials phone numbers, redials busy numbers, keeps track of appointments, and can print a mailing list of selected names. For the Apple II Plus; floppy disk, \$79. Christopher Systems Corp., 2775 Glen-dower Ave., Los Angeles, CA 90027.

Alybadix, a chess-solving program that includes operation instructions, a simplified version of the Matebadix Intelligent program, and is ideal for solving one to two players' chess problems. For the Apple II; floppy disk. Price not available. Ilkka Blom, Palosaarentie 13-17 C 27, SF-65200 Vaasa 20, Finland.

Apple Typewriter Word Processor, a utility package. A full-function word processor requiring no additional hardware that features unlimited document size, wordwrap and right justification options, mnemonic editing commands, and more. For the Apple II Plus and IIe; floppy disk, Ultra Software Applications, 900 Bellewood Dr. SE, Kentwood, MI 49508.

Bulk Mailer, a direct-marketing program that features mailing-list management with a 32,000-name capacity, duplication search, and other options. For the Apple II; floppy disk, \$125. Satori Software, 5507 Woodlawn Ave. N, Seattle, WA 98103.

Crime Wave, a fast-action chase game. Lawlessness runs rampant in this city. Hop into your trusty cruiser and round up would-be bank robbers before their Robot Rammers turn traffic into a demolition

derby. For the Apple II; floppy disk, \$19.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

The Golf Handicapper, a program that keeps track of a golfer's overall handicap and stroke and putting averages. For the Apple II Plus and IIe; floppy disk, \$19.95. Sunshine Productions, 108 Courtright, San Rafael, CA 94901.

Golfsoft Statistician, a golf-analysis program that lowers the golfer's score by evaluating each stroke on the basis of impact feel, initial and resultant directions, trajectory, and relative distance. For the Apple II Plus; floppy disk, \$34.95. Golfsoft Inc., 10333 Balsam Lane, Eden Prairie, MN 55344.

IDS (Integrated Development System). This utility package provides sets of screen management, disk file I/O, and printline formatting subroutines. For the Apple II Plus and IIe; floppy disk, \$85. R.R. Michaels Inc., POB 2712, Reston, VA 22090.

Keyshoppe, a grocery-shopping program. Make your weekly grocery shopping more efficient with accurate lists that can save time and money. For the Apple II Plus and IIe; floppy disk, \$39.95. Universal Instrumentation, POB 5254, Huntington Beach, CA 92615.

Menu Builder, a menu-writing program. You enter menu titles and file names and the program writes a menu program in Applesoft. It also allows screen formatting and editing and can build a menu directly from the disk catalog. For the Apple II; floppy disk, \$9.95. Jim's Software, 384 The Great Road, Bedford, MA 01730.

The Menu Writer, a utility program that lets you execute a file on disk by typing a single keystroke instead of the whole filename. Menus are written in Applesoft BASIC or Integer BASIC. For the Apple II, II Plus, and IIe; floppy disk, \$29.95. Micro Unicorn Co., 2156 Mendota Way, San Jose, CA 95113.

New World, a multiplayer educational game for all ages. The year is 1495 and you are in the race for supremacy of the New World. Raise your flag in many colonies, recruit large armies, and return to your country with gold. For the Apple II; floppy disk, \$29.95. Automated Simulations/EPYX, 1043 Kiel Court, Sunnyvale, CA 94086.

Quick File II, a utility package that manages files of 150 to 250 records. It allows you to turn your receipts, lists, and schedules into coherent, accessible reports and can print tables, mailing labels, and index cards. For the Apple IIe; floppy disk, \$100. Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014.

Softsight, a comprehensive machine-language debugging tool. You can observe, analyze, and control the execution of machine-language programs to understand how they work, optimize them, or locate problems. For the Apple II and IIe; floppy disk, \$40. Overdrive Computer Corp., Suite 2102, 1131 University Blvd., Silver Spring, MD 20902.

Speedstat 1, a statistical-analysis system that produces presentation-quality printed reports applicable to all types of research. You can gain immediate access to statistical information without any pre-

vious computer experience. For the Apple II; floppy disk, \$250. Softcorp International, 229 Huber Village Blvd., Westerville, OH 43081.

Thunderbombs, a fast-action arcade-type game. Out for a cruise in your interstellar cloudship, you are suddenly trapped in a deadly crossfire of alien dronebombs. To destroy the attacking aliens, you must first eliminate their supply ships. For the Apple II; floppy disk, \$19.95. Penguin Software (see address above).

Atari

Brain Boggler. Music, sound, and color add to the challenge of unraveling a mysterious color code hidden in the computer's memory. Find it before time runs out. For the Atari 400/800; floppy disk, \$16.95. Educational Software Inc., 4565 Cherryvale Ave., Soquel, CA 95073.

The Blade of Blackpoole, an adventure-type game. Recover the magical sword Myrarglym from a dangerous, underwater cavern and return it to the altar it was stolen from. For the Atari 800; floppy disk, \$39.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Graphics Machine, a program that allows you to create high-resolution graphics by typing in simple commands such as line, box, circle, polygon, fill, and save-screen. You can retrieve them within five seconds. For the Atari 800; floppy disk, \$19.95. Educational Software Inc. (see address above).

Space Games, three arcade-type games. If you are successful in Aliens, Survive,

Software Received

and Robot Attack, you can become a member of the Videowiz Patrol. Requires a joystick. For the Atari 800; floppy disk, \$24.95. Educational Software Inc. (see address above).

Spy's Demise, an arcade-type game. Your mission is to reach the top floor of an embassy, avoiding guards in the elevators, and gather pieces of an encoded message strategically hidden on each floor. For the Atari 400/800; floppy disk, \$19.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

Tricky Tutorial #2: Horizontal & Vertical Scrolling, an educational program that teaches you how to scroll text and graphics horizontally, vertically, diagonally, or even partially. Requires a joystick. For the Atari 400/800; floppy disk, \$19.95. Educational Software Inc. (see address above).

Twerps, an arcade-type game. As Captain Twerp, you must rescue nine fellow twerps stranded on an asteroid. In your Twerp-Craft, shoot Orbiters, avoid Glingas and Gleepnoks, and land before running out of fuel. For the Atari 800; floppy disk, \$34.95. Sirius Software Inc. (see address above).

CP/M

C Compiler, a language-compiler program designed to operate as either a native or cross compiler. It allows C programs to be transported, without change, within a group of Unix-compatible systems. For CP/M-based systems; floppy disk, \$350. Telecon Systems, Suite 218, 1155 Meridian Ave., San Jose, CA 95125.

CBASIC Compiler, a utility package of a compiler, link

editor, and library that contains features such as structured control statements, functions, and a variety of data types. Other features include parameter passing, local and global variables, and chaining between programs. For CP/M-based systems; floppy disk, \$500. Digital Research Inc., 160 Central Ave., POB 579, Pacific Grove, CA 93950.

CP/M Plus, an advanced version of CP/M that manages and supervises a computer's resources, including memory and disk storage, screen, keyboard, printer, and communications devices. It also handles information stored magnetically on disk and can copy files from disk to memory or a printer. For CP/M-based systems; floppy disk, \$350. Digital Research Inc. (see address above).

dBRx, machine-language routines that add several mathematical functions such as sine, cosine, arc tangent, and others to enhance dBASE II. For CP/M-based systems; floppy disk, \$150. Gryphon Microproducts, POB 6543, Silver Spring, MD 20906.

Display Manager, a utility program that helps programmers and independent software vendors save time by creating and modifying CRT (cathode ray tube) screen displays. Application programs written in a Digital Research language can later reference these screen displays. For CP/M-based systems; floppy disk, \$400. Digital Research Inc. (see address above).

General Ledger, an assembly-language program designed for business use. This menu-driven program contains six reports and a breakdown of accounts by departments. For CP/M-based systems; floppy disk, \$99.95. Sunflower Software, 13915 Midland Dr.,

Shawnee, KS 66216.

ICE80 Utility Library, a collection of programming tools that contains character manipulations and scanning, text parsing and stringing, disk input/output, and other functions used when writing assembly language. For CP/M-based systems; floppy disk, \$40. Industrial Computing Equipment Corp., Suite B-3, 100 Timber Oak Court, Lynchburg, VA 24502.

Labelpro, a label-printing program that prints up to 100 labels in a variety of sizes. Companies can be selected by customer name, city, state, zip code, lead source, and customer comment. For CP/M-based systems; floppy disk, \$175. Compugreen, 3095 D South Peoria #275, Aurora, CO 80014.

Leadpro, a customer/prospect list that can record an unlimited number of comments for each company listed. Most messages can be answered with a single keystroke on this menu-driven program. For CP/M version 2.2-based systems; floppy disk, \$195. Compugreen (see address above).

Questext III, a general-purpose system for organizing, storing, and communicating textual information. You can edit from menu prompts without learning command syntax. For CP/M-based systems; floppy disk, \$299.95. Information Reduction Research, 1538 Main St., Concord, MA 01742.

Relocation Utility Package, an assembly-language toolkit consisting of four programs for examining the contents of a relocatable module. For CP/M-based systems; floppy disk, \$99.95. Microsmith Computer Technology, POB 1473, Elkhart, IN 46515.

Versa-file, a file-management system that creates, edits, and prints key-accessed files. Multiple and customized forms can be created for printing each file and records of files can be sorted before printing. For CP/M-based systems; floppy disk, \$69. Analytic Management Systems, 247 High St., Palo Alto, CA 94301.

Commodore

Collision, an arcade-type game in which you maneuver a growing line on the screen, avoiding walls and obstacles while making your opponent crash. Nine levels of difficulty; requires a joystick. For the Commodore 64; floppy disk, \$15.95. Topologic, POB 752, Burlington, IA 52601.

Deadly Skies, an arcade-type game. Equipped with a squadron of five helicopters, you must destroy an enemy military base. Action increases with each of 32 play levels. For the Commodore VIC-20, cassette, \$39.95. Tronix Publishing Inc., 8295 South La Cienega, Inglewood, CA 90301.

Gold Fever. You assume the role of a gold miner who must gather all the gold in a mine shaft while avoiding runaway box cars, boulders, and claim jumpers. And you must do all this before the oxygen in the mine runs out. For the Commodore VIC-20; cassette, \$39.95. Tronix Publishing Inc. (see address above).

MAS-64 Accounting System, an accounting-systems package containing three modules: General Ledger, Accounts Payable/Checkwriting, and Accounts Receivable/Billing. For the Commodore 64; floppy disk, \$199 per module. Infodesigns Inc., 6905 Telegraph Rd., Birming-

the 9 power jewels in each of 16 levels of the maze and return them to your mother-ship. Avoid or destroy alien ships with bullets or a limited supply of antimatter bombs. For the Apple II; floppy disk, \$34.95. Sir-tech Software Inc., 6 Main St., Ogdensburg, NY 13669.

Atari

A.E., an arcade-type game. Squadrons of menacing sting rays are attacking you and eluding your missiles. You will be doomed unless you can chase them into outer space. Requires a joystick. For the Atari 400/800; floppy disk, \$34.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Crisis Mountain, an arcade-type game. Your mission is to defuse bombs planted by terrorists in the treacherous caverns of an active volcano. To reach them you must go through a maze avoiding boulders, tunnels, lava, and a radioactive bat. Requires a joystick. For the Atari 400/800; floppy disk, \$34.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

G.I. Joe Cobra Strike, an arcade-type game. The headquarters of the Special Mission Forces is under siege by the archenemy, Cobra, an evil organization determined to take over the world. To defend the camp, you must destroy the cobra. For the Atari 2600; cartridge, \$30. Parker Brothers, 50 Dunham Rd., Beverly, MA 01915.

No Escape, an arcade-type game. Jason has taken the Golden Fleece and angered the gods of Olympus. Imprisoned in the Temple of Aphrodite and armed with stones and magic bricks, Jason must fight frenzied

Furies. For the Atari 2600; cartridge, \$29.95. Imagic, 981 University Ave., Los Gatos, CA 95030.

Repton, an arcade-type game. As you take over the controls of the Star Fighter *Armageddon*, the Quarriors are attacking Repton. Stop them using your laser gun, nuke bombs, radar screen, and energy shield. For the Atari 800 and 1200; floppy disk, \$39.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Sky Blazer, an arcade-type game. You'll need the WWII jet to clear away radar stations, avoid supersonic tanks, find and destroy ICBM installations, and escape missiles as you make your final bomb run on the Bungeling Empire headquarters. Requires a joystick. For the Atari 400/800; floppy disk, \$31.95. Broderbund Software Inc. (see address above).

Sky Skipper, an arcade-type game. The sky's the limit for young players as they control a dive-bombing plane on a daredevil rescue mission. Pilots come to the aid of helpless kittens, turtles, ducks, and rabbits held captive by gorillas. For the Atari 2600; cartridge, \$30. Parker Brothers (see address above).

Strawberry Shortcake, an arcade-type game for ages 4 to 7. The Purple Pieman cast an evil spell on Strawberry Shortcake and all her friends. Now everyone has a body that's all mixed up. See if you can put Strawberryland characters back together again. For the Atari 2600; cartridge, \$30. Parker Brothers (see address above).

Telengard, an arcade-type game. You control a character who must descend to the depths of Telengard and battle monsters. Gain strength

by finding enchanted items. Six levels of play. For the Atari 800; cassette, \$23. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Commodore

Bartender's Friend, a bar-recipe guide and liquor term-definer program. This automated program contains hundreds of recipes and bar terms. For the Commodore 64; cassette, \$9.95. Raymond L. Reynolds, 384 Hyacinth St., Fall River, MA 02720.

Practicalc, an electronic-spreadsheet program that lets you perform bookkeeping operations, several mathematical functions, and projections. You can enter titles and numerical data into rows and columns. For the Commodore VIC-20; cassette, \$39.95. Micro Software International Inc., 50 Teed Dr., Randolph, MA 02368.

Programmable Characters Package. With these three programs, Single-Edit, Multi-Edit, and Data Generator, programmable characters can be designed either singly or in up to 5 by 5 blocks. Requires a joystick. For the Commodore VIC-20; cassette, \$14.95. Sunshine Software, POB 473, Portage, MI 49081.

Telengard, an arcade-type game (see description under Atari). For the Commodore 64 and PET 2001; cassette, \$23. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

IBM Personal Computer

Cross Reference Utility, a programming aid that provides the BASIC programmer with a complete reference listing of variables within a

BASIC program. You can review, analyze, and modify the program to maximum capability. For the IBM Personal Computer; floppy disk, \$29.95. Prentice-Hall Software Inc., Route 9W, Englewood Cliffs, NJ 07632.

Night Mission Pinball, a simulated pinball game in which your plane is in a World War II night bombing run. Use up to four balls and flippers to score in a playfield with five bumpers, seven targets, nine rollovers, and two spinners. For the IBM Personal Computer; floppy disk, \$39.95. Sublogic Corp., 713 Edgebrook Dr., Champaign, IL 61820.

PL/I-86, an implementation of the PL/I language based on the ANSI General Purpose Subset. The package includes a reference manual, programming guide, and command summary. For the IBM Personal Computer; floppy disk, \$750. Digital Research, POB 579, 160 Central Ave., Pacific Grove, CA 93950.

Peachtext 5000, a package that combines word processing, financial planning, and simple database management features for a complete personal-productivity system. It incorporates Random House Electronic Thesaurus, the Peachcalc electronic spreadsheet, and more. For the IBM Personal Computer; floppy disk, \$395. Peachtree Software Inc., 8th Floor, 3445 Peachtree Rd. NE, Atlanta, GA 30326.

Pie:Writer, a word-processing package that includes split-screen editing, full use of the keyboard, and customized function-key support. This program can process two files at once and provides virtual-file storage. For the IBM Personal Computer; floppy disk, \$199.95. Hayden Software Co., 600 Suffolk St., Lowell, MA 01853.

What's New?

directly from the BCN computer center, is also available. Additional network services include electronic mail, an information system, and an electronic magazine and newsletter.

Currently, BCN does not charge subscriber fees. A minimum monthly charge of \$5 covers operating ex-

penses and services. A free system disk and a system overview can be obtained by contacting the Business Computer Network, Suite 1220, Gill Plaza, 9601 McAllister Freeway, San Antonio, TX 78216, (512) 340-8201.

Circle 624 on inquiry card.



Classroom Use Possible with Two-Way Network

The Network 216 and the Monitor 16 are at the heart of the first network system designed for complete two-way communications between a master station and its satellites. This system, created by Wolsten's Computer Devices, is designed for any situation in which more than one computer is used at a given time, such as in a computer class. Uploading, downloading, and the ability to send information to a printer are provided. Communication is both video and audio. A dedicated computer is not required.

The Network 216 scans up to 16 active Atari computers and requests if any action, say uploading or sending data to a printer, is required. It automatically proceeds from one computer to another, skipping inactive units. Its data rate

is 19,200 bits per second. The Network 216 uses Atari DOS and can handle up to four disk drives and a printer.

The Monitor 16 expands and enhances the system. It can monitor any of the 16 Ataris individually at the turn of the dial. When used with any television set, the Monitor 16 can display the same video information that is appearing on each computer. Audio communication is made possible through the use of a headset with an attached microphone.

A hard-disk option will be available for the system. For additional information, contact Wolsten's Computer Devices Inc., 99 Washington St., East Orange, NJ 07017, (201) 678-0408.

Circle 625 on inquiry card.



Integral IBM PC, XT Modem

The Bizcomp PC:Intellimodem is an integral Bell 212-compatible modem for the IBM Personal Computer. It can communicate at 300 or 1200 bps (bits per second) and offers integrated voice and data capabilities. Its telephone handset permits program-controlled switching between voice and data communications without requiring a redial. The handset, for example, can be used to monitor communications or to supply voice and Touch-Tone input under control of the Personal Computer. Standard features include auto-dial, auto-repeat dial, and auto-answer. The PC:Intellimodem comes with a menu-driven communications software package that provides more than 50 commands and status checks.

The PC:Intellimodem is marketed through a network of IBM dealers. Its suggested list price is \$499. Contact your local IBM dealer or write to Inquiries Manager, Bizcomp Corp., POB 7498, Menlo Park, CA 94025. Circle 626 on inquiry card.

IEEE-488-to-Ethernet Interface

An interface board that connects computers with an IEEE-488 GPIB port to an Ethernet local-area network has been announced by Xebec. VLSI technology is used in this board to carry out the physical and data-link control layers of the ISO Ethernet specification. A dedicated microprocessor provides high-level command protocols to the


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Software Received

Professional Unit, a set of utilities for professional Pascal programming that includes Date, Dollar, Phone, Zip-code, Tax Rates, and special facilities for defining fields on the screen. You can double or triple your programming speed. For the Apple II; floppy disk, \$39. D & L Computing, 1201 Lincoln Ave., New Castle, IN 47362.

Suspended, an interactive game. After a 500-year sleep, you awake and must strategically manipulate six robots acting as your senses. One even helps you access information from memory banks as you solve an intertwined myriad of graphically realistic and original problems. Several levels of play. For the Apple II; floppy disk, \$49.95. Infocom, 55 Wheeler St., Cambridge, MA 02138.

Troll's Tale, an educational adventure game for children ages 8 and up. Children develop reading comprehension as they make maps, identify details, make inferences, predict outcomes, and draw conclusions in order to locate 16 treasures. For the Apple II, II Plus, and IIe; floppy disk, \$29.95. Sierra/On-Line Inc. (see address above).

Wizplus, a utility program for the Wizardry adventures that lets you quickly change, restore, add to, modify, recover, edit, or move any of your characters, their equipment, spells, or treasures. No more frustrating games where the wizard always wins. Now you have a chance. For the Apple II Plus; floppy disk, \$39.95. Datamost Inc., 8943 Fullbright Ave., Chatsworth, CA 91311.

Atari

Matchboxes, a skill and concentration game. One or two players must match identical

squares from a 6 by 6 grid and solve a hidden word puzzle. Each colorful character, creature, or object has its own catchy musical signature. For the Atari 400/800/1200; floppy disk, \$29.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Suspended, an interactive game (see description under Apple). For the Atari 400/800; floppy disk, \$49.95. Infocom, 55 Wheeler St., Cambridge, MA 02138.

Ultra Disassembler, a utility package that lets you recreate source code. This labeling disassembler handles DOS files and code. Output code may be written to video display, printer, or disk file. For the Atari 400/800/1200; floppy disk, \$49.95. Adventure International, POB 3435, Longwood, FL 32750.

CP/M

ACNAP, an AC network-analysis program. This electronic-circuit program can handle circuits as large as 70 components. It is optimized for speed and can analyze a five-node, ten-component circuit in less than one second. For CP/M-based systems; floppy disk, \$39.95. BV Engineering, POB 3351, Riverside, CA 92519.

Access Manager, a general-purpose, keyed, file-accessing package designed for programmers creating application programs that must access data records on the basis of identifying such key values as name or number. For CP/M-2.2-based systems; floppy disk, \$300. Digital Research, 160 Central Ave., POB 579, Pacific Grove, CA 93950.

CP/M Workshop, a non-technical CP/M learning pro-

What's New?

MASS STORAGE



HP-Compatible Winchesters

The Series 3000 line of Winchester hard-disk subsystems from Bering Industries is designed for Hewlett-Packard computers. This 12-member family offers storage capacities of 5, 10, and 15 megabytes and an average transfer rate of 174,000 bytes per second. The 8085 microprocessor and the 2900 bit-slice chip are integrated with the controller, and a 5-bit error-correction-code circuit is built in for added data integrity. Storage can be partitioned into formatted blocks.

The Series 300 is hardware-, software-, and media-compatible with such HP technical and personal computers as the HP1000, Series 80, and 64000 development systems. Connection is via the HP-IB; no hardware or software modifications are required.

The Series 3000 can be equipped with a variety of options, including integral 3½-, 5¼-, or 8-inch floppy-disk drives. Other options

include a multiport feature, an intelligent controller for local backup, and disk-sharing capabilities. Series 3000 prices range from \$2860 to \$4260. For complete product descriptions, contact Bering Industries Inc., 747 East Brokaw Rd., San Jose, CA 95112, (408) 298-8552.

Circle 691 on inquiry card.

Disk Subsystems for OEM Market

PH-Associates' Mark line of disk subsystems for OEMs have a 30-millisecond average access time. Capacities of 20, 33, and 46 megabytes are available. Said to be identical in size to the standard 5¼-inch floppy-disk drive, these subsystems come with a smart controller featuring intelligent formatting and automatic sectoring. The transfer rate is 5 megabits per second, and the line interfaces to S-100, Z80, Apple, IBM Personal Computer, Radio Shack

TRS-80, and many 8-bit parallel computers.

The Mark is available as a complete subsystem assembled into either a stand-alone or rack-mountable chassis or it can be integrated into an existing chassis. OEM quantity one prices begin at \$3000. Contract PH-Associates, 8720 Old Courthouse Rd., Vienna, VA 22180, (703) 281-5762.

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Dual-Mode Streaming Tape Backup

The 20-megabyte Sysgen Image streaming cassette-tape backup for the IBM PC XT gives you a choice of two backup modes: Preserve and File-save. Preserve saves a volume of disk data and restores it on another disk. It has a catalog utility that lists all the files by tapefile identification, and size. Filesave allows individual files or groups of files to be saved from hard disk to the tape, and vice versa. Its catalog utility lets you see all the files on tape, a specific range of files, or a particular file.

Image provides complete archival backup of hard-disk information at the rate of 2.5 megabytes per second. Compatible with CP/M-86 and PC-DOS, this subsystem comes with a controller, electronics, and drive mechanics. Word processing, database management, spreadsheet, and other demonstration software are supplied with Im-

age. It costs \$995, which includes interface card, cables, and the software. Contact Sysgen, 47853 Warm Springs Blvd., Fremont, CA 94539, (415) 490-6770.

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Intelligent Drives for Atari 400/800

Trak's single-density AT-D1 and double-density AT-D2 intelligent drive systems work with Atari 400/800 computers. These drives feature an onboard microprocessor, programmed memory, and a digital track counter. Standard controls include a pressure-sensitive control panel that provides information on system activity through read/write indicators, a touch-sensitive write-protect switch for securing data, and an intelligent controller interface for a Centronics-type parallel printer.

These drives have half-height mechanisms with steel-band head positioning and direct-drive beltless DC motors. Track-to-track access time is 5 milliseconds. The AT-D2 costs \$499. For full details, contact Trak Microcomputer Corp., 1511 Ogden Ave.,

Shaping Consumer Software

Trip Hawkins of Electronic Arts explains his criteria for judging software and presents his view of the programmer as artist

by Phil Lemmons and Barbara Robertson

The Aesthetics of Software

To judge computer software, we first need a basis for criticism, just as literature and other forms of creative endeavor have their own criteria for excellence. The most famous basis for judging drama, of course, is Aristotle's doctrine that tragedy must preserve the "three unities" of time, place, and action. But computer programs have an important characteristic that literature lacks: multiple branching. Computer programs have hundreds and thousands of conditional steps, and a user can run a program many times without ever taking the same path twice. Furthermore, the computer has special characteristics as a medium.

When William M. "Trip" Hawkins, president of Electronic Arts, talks of the need for home computer software to be "hot, simple, and deep," he is suggesting a set of criteria for judging software. In the interview that follows, he explains those three terms in a way that amounts to an essay about the aesthetics of home computer software—a basis for criticism of home entertainment and educational programs. Hawkins's views should prompt discussions among computer users about the nature of software, and in time those discussions may form the basis of an aesthetic to stand alongside those of literature and art.

BYTE West Coast Bureau Chief Phil Lemmons and West Coast Technical Editor Barbara Robertson interviewed Hawkins at Electronic Arts' office in San

Mateo, California. BYTE's questions to Hawkins appear in boldface, and Hawkins's responses follow in lightface.

What Software Should Be Like

You have said that software must be "hot, simple, and deep." Did you borrow those terms from some latter-day Marshall McLuhan?

No, I made them up. "Simple" came from Lisa. The first time I started talking about computers as a medium was when I started talking to people about Lisa. At Apple we were trying to get people to understand why Lisa software was only possible with Lisa hardware. And the medium is the message.

"Simple" just means I can minimize the amount of time it takes for somebody to get into the product. In that sense, "simple" can apply to any kind of application, whether it's a game, an educational product, something to satisfy the intellectual curiosity of an adult, or something that pays your bills for you.

When I worked at Apple, we had a struggle with Lisa in the early going. The engineers wanted to know whether or not the person who would be operating the Lisa would be a naive or sophisticated user. We finally convinced them it really didn't matter whether it was a CEO or a secretary—everybody considers his

or her own time precious and wouldn't want to spend any time learning to use the computer and software.

And in the consumer market, leisure time is precious, too, whether it's Johnny's leisure time after school or a parent's on the weekend. Nobody wants to spend time studying a manual to play a game. The idea of having to read a manual to play a game is pretty scary in itself.

The "simple" part has to do with how the program is presented on the screen and what kind of controls you use to interact with it. For example, Mule is an economic simulation game, and there's a whole lot going on. There are a lot of financial transactions, but you never do anything except move your joystick and push the button.

"Hot" has more to do with how you take advantage of what a specific computer can do. For example, the Atari offers much better sound than the Apple, so it's important for an Atari machine and an Atari owner to get a product that takes advantage of that. "Hot" means how well this product uses the heat that's in this medium, how well it takes advantage of the special things it can do.

You're always trying to take advantage of the maximum rate at which somebody can absorb information. And getting the medium as hot as

possible makes it easy to do that.

The computer really has four things going for it as a medium. Two are sound and video—you have to use sound and the screen to the fullest advantage. The third asset of computers is their interactiveness—the natural feedback loop. People get a lot just from the machine making a funny noise because of some action they've taken. The fourth asset is what I call "hidden machinery," the fact that the computer, because it's a data-processing machine, can take an enormous amount of information and keep track of it, providing a structure for it that is completely invisible to the consumer.

The best example I can think of is *Flight Simulator*. All you can see on the screen is the view out the cockpit and the controls spinning around, but there's all this scaffolding behind it that will sustain you in the air, and you don't have to deal with any of that.

Flight Simulator creates a realistic experience. Realism usually is based on data, and the more data you have for a situation, the more realistic it is. But if that data is apparent to you as you use the program, then the complexity is going to be apparent to you. And that's the problem. Imagine what *Flight Simulator* would be like if I played it as a board game. It would be a disaster. I'd be constantly computing my velocity, my altitude, and all kinds of other things.

The same thing goes for adventure games. Think of an experience like *Dungeons and Dragons*, where you're trying to create a very realistic adventure. There are all these charts and tables and complicated manuals, and you're trying to figure out how much weight each person's carrying



Trip Hawkins

and where he's holding different weapons, how much each one is paid for the weapons, what kind of damage the weapons do when they hit, what percentage of the time they hit, and what kind of monster they're attacking. You have to keep track of all this data. Computers are really good at keeping track of that, and they should be used to hide the machinery.

Getting a program to be hot is a combination of taking advantage of all four of a computer's assets. I think you're failing to fulfill the promise of home computing if you're not pushing those as far as you can with a particular idea. Video games tend to be purely visually oriented; sound effects haven't been that far advanced. With a really good video game you've got some interesting interaction, some interesting graphics, and some interesting sound, but you're not taking advantage of the hidden machinery.

That's partly why "deep" comes in. A lot of video games are simple and hot, but almost none of them are deep. A lot of that has to do with the fact that an arcade is a crazy place

with lots of noise and distraction. You can't take time to think about what you're doing; you've just got to be reacting. And the experience has to be over and done with in 60 seconds. In the home you don't have that constraint, so you can do things differently and offer greater variety.

I don't think anybody's going to have sustained interest in something that's not involving them at all mentally. A mindless reaction is OK for a few minutes' relaxation, but it's certainly not going to become a large portion of your leisure time over years.

Parents don't particularly want to encourage that, anyway. What they really want is products that have *depth*. Again, if I can use *Mule* as an example, it's a very complicated economic simulation. But when you start playing, there's a beginner version, so some of the complexity is very deliberately stripped out of it, and you only have to learn how to move the joystick and press the button. There are some very interesting music and graphics, and it's still more complicated than a typical video game. In other words, you have to learn how to do a few things and understand a few mechanisms on the screen. Once you get those down, you know how to play.

But learning how to become a good player of the tournament game is totally different—by the time you're playing for the fiftieth time, you're still learning things about it. And a lot of the basic rules of economics are cleverly concealed, so you learn things like the learning curve theory of production, economies of scale, basic supply and demand and bargaining, acquired resources and scarcity or controlling price through

market share, and collusion. It's phenomenal how much is going on.

Even so, when you start out it can be very simple; in fact, you can do other things in the game to handicap people. If, for example, you have an adult playing with a 10-year-old for the first time, the child can be given a special character that has more points and has a longer turn, and the adult can be handicapped. The way you handicap adults is to make them humanoids, and since the game takes place on a foreign planet, you assume that its harsh climate affects the humans.

Simple, Hot, and Deep in Other Software

Do ideas like "simple" and "hot" apply to both educational and entertainment software?

Yes. Anyone who tries to make a distinction between education and entertainment doesn't know the first thing about either. I see the meat of this market in products that combine entertainment and education and don't consciously try to separate the two. A part of our market is still pure fun, and another part is pure learning, but I think the meat of the market is those two in combination.

We see two other parts of the market as distinct. We call one "personal development" just because that's a better way of describing the way an adult thinks about education. In more cases than not, you're indulging a particular intellectual curiosity about how computers work, about music, art, chemistry, or anything you feel like learning about or tinkering around with. A computer is a very interactive playmate for doing that.

The fourth market after entertainment, education, and personal development is home management. That divides into information management and financial management. Information management includes word processing, retrieving information from other computers, and so on. And then there's financial management, which includes things like how to make financial planning decisions and how to figure out how to finance a new house or get your taxes

paid.

Do you see those things as straightforward business-like applications or as games as well?

I think there's a direction we can go there, but people still fundamentally want to get the job done. I think we can make the experience of getting the job done a lot more interesting.

Sound effects for bouncing checks?
I think there probably will be some

We're trying to encourage people like Gahan Wilson to get involved with the computer because they're in the business of using an artistic medium to evoke an emotional response.

playfulness for that sort of thing, but it had better not get in the way of efficiency. Simple applies equally well across all those categories. Hot also applies equally well because you're trying to figure out how to take what a specific computer can do and make it as compelling as possible. Deep really has more to do with whether or not I find the bottom of the product quickly. Clearly, I don't want to find the bottom of it quickly; I want it to continue to be interesting, continue to unfold.

We understand some of your programs are going to involve interesting collaborations.

We're trying to get people like Gahan Wilson involved with the computer because they're in the business of using an artistic medium to evoke an emotional response. Most people in computers haven't thought about the medium that way. We're really trying to encourage that. I think it's going to take a style of software development that's more accessible, where programming is no longer exclusively the province of the people who know how to handcraft assembly code. People who know how to handcraft assembly code seldom are as aesthetically oriented as Bill Budge or as oriented toward emotion as a

great film director. You're going to start to see more collaborative efforts.

Rock, Flicks, and Object Code

Every artist shapes a creation or performance around the capabilities of the equipment used. The musician must work with vocal cords or the harmonics of an instrument. The actor calls upon facial expression, body movements, and the particular characteristics of the film camera. The software programmer, too, must shape a program to existing technology. But the personal computer goes one step beyond by allowing interactivity. A performance becomes an integration of the user, the programmer's software, and the hardware. Yet the programmer, unlike the performer, takes a back seat to the instrument—the computer—when it comes to recognition. With the exception of a few famed instruments such as the Stradivarius violin, praise for the equipment over the performer does not occur anywhere but in the software programming industry.

Still, the entertainment industry provides parallels for the software industry. Both combine the skills of many people to produce a product—be it an album, a motion picture, or a program. Financial arrangements, however, vary considerably.

In the popular music industry, the songwriter, the musician, and the producer generally get royalties. The musician divides royalties with an agent, a business manager, a personal manager, and perhaps a public relations firm. In the motion picture industry, the company is the producer. Screenwriters get fees or perhaps a small percentage of the film's earnings. The actor gets fees, a percentage, or both, and usually pays some part of the earnings to an agent, a business manager, a publicity agent, and so on.

The software industry is different. The programmer may be an employee who writes code to implement someone else's idea, or he may generate the original idea, the detailed design, and the code itself. In the latter case, the programmer can sell the program for a flat fee, give it to a publisher in exchange for a royalty, or produce copies and contract with a distributor to sell to retail stores or directly to users.

Trip Hawkins and Electronic Arts are

leaders in the movement to treat programmers as artists and reward them accordingly. As Hawkins notes, however, the analogy of the software business to show business can easily be strained.

When did you get the idea to organize this software house on a different model?

At Apple, while we were working on Lisa. Lisa software was inhibited by the need to have so many people simultaneously in agreement. That would be difficult regardless of the collection of people involved.

It occurred to me that in film, television, books, and other forms of entertainment media, artists all work kind of independently. And already by that time there were certainly examples of that in programming. Bill Budge, for example, had done some space games and then he worked for Apple for six months.

I think a lot of software people have plunged into building a huge software organization without realizing the limits to growth that eventually you're going to have to live with.

What are those?

The "mythical man-month," for one. Nine women can't make a baby in a month. And there comes a point in a software project where if you add more people it'll never get done. And I think that you have to find ways to keep things decentralized. Our model of the world is sort of the ultimate in decentralization.

The question is, how can we make these talented programmers and program designers who are working scattered all over the world as productive as possible? Once we can answer that, making the company grow indefinitely is just a function of finding the best talent and leveraging it more effectively than someone else can.

We have all the advantages that go with a small company. We can have a more personal relationship with the programmers. Apple certainly wasn't a huge company, but it had a lot of trouble, as many corporations do, dealing with the idea of putting the software people on a pedestal and treating them differently from everyone else. I realized, hey, they are dif-

ferent—let's put them up on a pedestal.

Based on your view of home computers as a new medium and of programmers as artists, how have you organized Electronic Arts differently from other software houses?

The most important department is the talent department, and that's staffed with producers. Producers

Our producers are very important people—they're a little like book editors, a little like film producers, and a lot like product managers.

basically manage the relationship with the artist. They find the talent, work out product deals, get contracts signed, manage them, and bring them to their conclusion. The producers do most of the things that a product manager does. They don't do the marketing, which in some cases product managers do. They don't make decisions about packaging and merchandising, but they do get involved.

They're like book editors, then?

Yes, they're a little like book editors, a little bit like film producers, and a lot like product managers. I think the biggest time sink for a producer over the full course of the product development is working with the software artist while he's finishing the software—turning around new releases and getting the bugs eliminated and getting manuals straightened out. Usually what happens on the manual is that the original artist will provide something in some rough form, and the producer will figure out how to turn that into a final manual.

Do producers get salaries?

Yes, they're on salary. Some day, when it becomes really easy to figure out a measure of a producer's effectiveness, these people will get a piece of the action. Their performance will be based on how well the products do. I'm already trying to get them to think like portfolio managers—you have this much cash to invest in

terms of advances, and you've got this kind of bottom line to play with in terms of what royalty percentage you can give out, so how much can you spend on the overall marketing, that sort of thing. The idea is to figure out how to produce the most revenue from that. And whether you want a couple of really expensive high-risk, high-reward possibilities, or some of those balanced with some inexpensive 18-year-olds and one more expensive educational group or whatever.

What are the producers' backgrounds?

We have five of them full-time right now. Three of them worked at Apple; in fact, two of them worked directly for me. One was product marketing manager for all the Lisa software, and she's very good at working with engineering people. The other two people from Apple had similar kinds of reputations for being good at working with engineering people. One producer sold computers for IBM and then became an executive recruiter. He signed Gahan Wilson. Our fifth producer, who came from one of our competitors, Automated Simulations, was basically doing all of the company's product marketing. She's basically a social scientist.

Are most of your contracts with individuals or with groups?

It's a range. You have guys like Bill Budge who are individuals and then you have guys from a company like Childware, where it's a group of about four. Then there's another category where there might be one key individual, somebody like Dan Buntin at Ozark Softscape or Jon Freeman at Free Fall Associates, Dan Buntin's the guy who did Cartels and Cutthroats, Cytron Master, and Computer Quarterback. He did those pretty much on his own, but now he has his brother and some other family members involved, and they set up a separate company.

Then you have people like Jon Freeman. He specializes in design—game design, not even program design. His wife, Anne Westfall, specializes in program design. And then there are two other guys that they work with; one is strictly a program-

mer, and the other is a combination programmer and game designer. so it's a little bit of everything. Actually, I guess right now the solo performers are the exception. We have only four or five who can really work that independently.

Do you, like book publishers, get unsolicited products, unsolicited disks?

We do. We expect that their volume is going to go up a lot once we're on the market.

Do you welcome that?

Absolutely, although you tend to have a very low hit rate—about one in a hundred or worse. I've already been through that at Apple, and Rich Melmon, our vice president for marketing, went through it at Visicorp. **When a programmer signs a contract with you, how is it likely to make his life different than if he were doing software on his own?**

It's a really big difference. The guy to talk to about that would be Bill Budge because he recently was running his own company. I know in Bill's case,

there's a lot of time you spend answering the phone, talking to distributors, getting orders, approving artwork or packaging, getting labels printed, doing mailings to dealers, just doing a whole lot of stuff that I find interesting. People like Bill

In some situations now we're much happier to be dealing with lawyers rather than programmers because they don't get freaked-out when they first see a contract.

find it thoroughly tedious. Some programmers out there enjoy it, and I think in some cases it will prove to be their downfall because they're not very good at it, but they like it, and so they'll do a mediocre job both running a company and trying to do the software.

Do you expect to be dealing with

agents for programmers some day? Sometimes we already do. They do exist. In some cases they're just lawyers, but, depending on the amount of experience they have, they can be very smart. There are situations right now where we're much happier to be dealing with lawyers because they don't get freaked-out when they first see a contract.

Contracts with Programmers

What are contracts with programmers like now?

The typical software contract spends most of the time talking about maintenance and support and stuff like that. Once the kind of software that we buy from an outsider is done, it's done, so there's less emphasis on issues like support. There's more emphasis, though, on the rights to different kinds of things. So in fact it's really much more closely modeled after a recording contract. We want to make sure that if we ever want to do "greatest hits of 1983," we can put all the programs on one disk.

What about the fundamental financial aspects of the contract?

It really boils down to a royalty rate on products that we manufacture, which is the market range, typically 10 to 20 percent of the wholesale revenue. Some manufacturers are more out of sync with the market than others, but I think over the next year the rates will become reasonably standard, the same way they are in the record business. Right now they're still all over the map.

How does the range in software compare with what's available in books?

We don't actually encourage too much of a range. So much of our business is driven by percentages of sales that you can't really justify paying a much higher percentage of sales to one guy than another guy. What you're really looking for is higher total revenue on a better product. If you look at our marketing costs, sales commissions, things like rack servicing fees and administrative and R&D budgets, they all tend to be set up as a percentage of sales. What you're really looking for in a big hit product is something that is going to do so much more sales volume that all of

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those percentages start to work in your favor.

So all your programmers will be getting the same royalty?

No, I wasn't trying to suggest that. A certain amount is a function of bargaining and a certain amount is just a function of what we think is fair. The rates are not widely disparate. The thing that does change is the amount of the advance, and that's a function of the track record of the software artist. If he or she really has a strong track record or if the software development method used is clearly more expensive than somebody else's, but we think it's the right method, then we're going to pay for it.

For example, right now we're working with Childware, a group that specializes in educational software. When people from the company came in and showed us their first script, it was something like 32 professionally drawn pictures on a storyboard. That kind of richness of communication is going to cost you.

Some of these groups now have a staff graphic artist and a staff musician, and they'll have certain expenses built into the way they do the development.

One other point I wanted to make about the royalties is that we divide things into three categories. There are royalty rates on products that we are actually manufacturing. There are two subcategories there. One is products where the programming is done by the original artist, who gets a residual royalty rate. If it's a derivative version that's on a machine in which the artist did not do the original programming, he still gets some royalty, and that's worked out.

The second category is licenses. For example, the Bolivian government says, "We'll pay you \$100,000 just for the rights to convert Pinball Construction Set to Bolivian." If there's a straight license, a much higher percentage of that goes to the artist because we don't have to do any manufacturing and distribution.

The third category really has more

to do with merchandising. We may want to create a product specifically for merchandising, but we're not the manufacturer. For example, a T-shirt. The royalty rate there will be very low because we're not anticipating making any money on it.

Research and Development

You also have a research and development department. With the software written mostly outside, what does the research and development department do?

Develop proprietary software tools that our software artists can use to build products faster and to build products that they couldn't build on their own.

Utilities that construct graphics for a particular machine?

Let me talk short term and then long term. In the short term there are things like software theft protection, assistance in getting up on a machine that the particular artist is not familiar with, and assistance with sound. It's more the nuts and bolts kind of thing right now.

In the long term, we're going to put together a workstation that is specifically designed for creating the kind of software that we want to create. And the development system will have things like languages and debugging tools and compilers, and it'll have a lot more memory and a lot more processing power than any of the machines that the consumer is ultimately going to own, today or in the future.

You're developing your own compilers?

We're not necessarily doing all of the development work ourselves. But we already have a FORTH compiler that runs on all four of our target machines for this year—the Apple, the Atari, the Commodore 64, and the IBM PC. We're bringing it up on our first version of the development system. We might have toolkits for sound and graphics, and so on.■

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□ without



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Ask BYTE

Conducted by Steve Clarcla

Joystick for the PC

Dear Steve,

I would like to build the joysticks for my IBM Personal Computer using Radio Shack's joystick potentiometer, Catalog No. 271-1705. Can you tell me how to wire up the potentiometer? The IBM manuals have been no help. Also, I hooked up a 13-inch Hitachi color television set to the IBM PC, but

I get poor resolution in the 80-character by 25-line mode. Any suggestions?

Robert Smith
Darien, CT

Adapting the Radio Shack joystick potentiometer to the IBM Personal Computer is easy (see figure 1). Of course, your PC will need a joystick interface card. Also, while the value of the 271-1705 joystick is rated at 100K ohms, the 30-degree travel of the

joystick handle may limit the range that can be controlled. If this is a problem, a potentiometer with a larger resistance will be needed. The total resistance change should be around 100K ohms.

The signal bandwidth of a color television is too narrow for an 80-character line to be displayed clearly. The only solution for sharp characters is to use a high-bandwidth (greater than 12 MHz) monitor. . . Steve

Atari 800 to VCS

Dear Steve,

I own an Atari 800 and am interested in making cartridges for the Atari VCS or 5200. Do the VCS and 5200 both use a 6502 chip? If they do, is it possible to use standard Atari assembly language for programming? If they do not use the 6502—or are not compatible with Atari assembly language—can you tell me if there is any other way to make cartridges for the VCS or 5200? (I understand that there is a board that lets you use an Apple II Plus for this purpose.) Any help will be greatly appreciated.

Scott Brause
Edison, NJ

The Atari 800 and the Atari VCS both use a 6502-type microprocessor and share the same machine language. It is therefore possible to develop games on your Atari 800 that will run on a VCS.

The boards for the Apple II Plus are made by

Frobco
POB 8378
Santa Cruz, CA 95061
(408) 429-1551

These units are real-time development systems consisting of a plug-in board for the Apple II and EPROM plug-in boards for the VCS or 5200. . . Steve

The Monitor and the Merriment

Dear Steve,

I have been using a BMC 13-inch color monitor with two home computers: a Commodore VIC-20 and a TI-99/4A. I also have another computer (built from an NRI kit) that is based on an

IBM CONNECTOR ON PADDLE BOARD

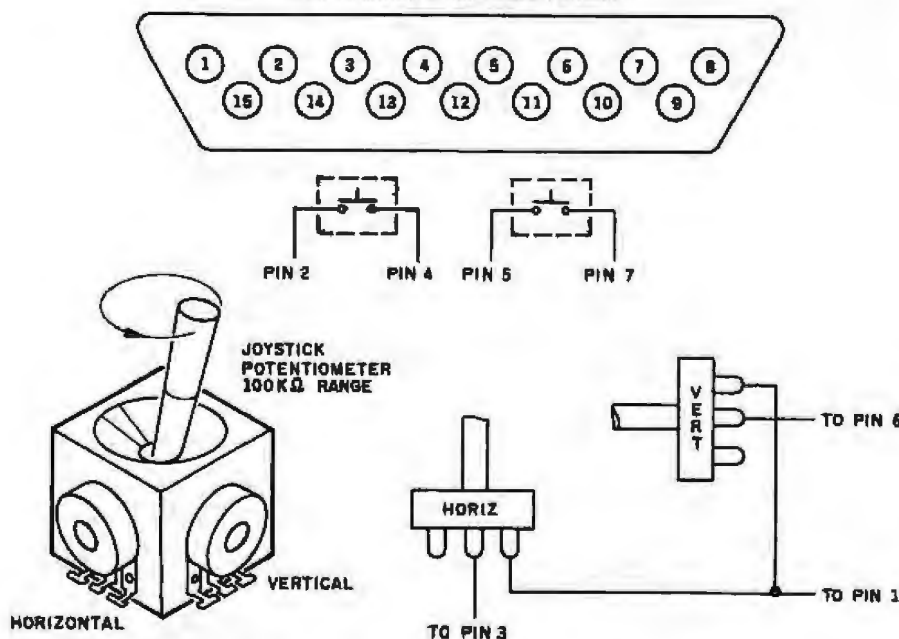


Figure 1: The technical specifications needed to employ a 100K-ohm joystick potentiometer as a joystick for an IBM Personal Computer.

Apple Disk Information

Dear Steve,

I would appreciate your help in finding sources of information about the operation (hardware and software) of the Apple II disk drives and disk-drive controllers.

Robert Kao
West Linn, OR

One of the best references on the operation of the Apple disk operating system is the book

Beneath Apple DOS by Don Worth and Pieter Lechner. Published by Quality Software, it is available at most computer stores. The book completely describes the DOS software and explains the disk formatting. Because many of the disk-drive functions are software controlled rather than hardware controlled, you will be off to a good start.

The Apple disk controller schematic on page 145 of the Apple DOS Manual shows that it does little more than turn

the drive on and off, move the stepper motor, and translate the disk pulses into a 6-bit hexadecimal code. The software that drives the controller is explained in Beneath Apple DOS. The disk analog card features the MC3470 read amplifier, which takes the differential AC signal from the disk's read/write head and converts it to a digital output pulse. It is amplified and filtered, sent to the controller for translation, and then sent to the data bus. . . Steve

Software Received

Apple

Bookends, a reference-management system that keeps track of information from articles, books, and magazines alphabetically using authors and keywords. This program offers storage and retrieval. For II Plus, IIe, and III; floppy disk, \$124.95. Sensible Software Inc., 6619 Perham Dr., West Bloomfield, MI 48033.

The Chambers of Vocab, an educational game that builds vocabulary skills. Your goal is to work your way up and out of the Chambers of Vocab by demonstrating vocabulary skills. Up to four players can choose from three difficulty levels. For II, II Plus, and IIe; floppy disk, \$48.96. Reader's Digest Services Inc., Pleasantville, NY 10570.

The Cheap Assembler, a menu-driven, interactive editor/assembler system that lets you edit, assemble, list, and execute 6502 assembly-language programs without leaving the system. The program includes editor commands, assemble-time error messages, and assembler syntax. For II Plus and IIe; floppy disk, \$23.50. Thunder Software, POB 31501, Houston, TX 77231.

Home Investment Package, a series of three sections: the stock-tracking program, the compound-interest program (for any account that offers a compounded interest), and the main menu, which allows you to move from the stock program to the compound-interest program. For II Plus and IIe; floppy disk, \$15. Yes Software, 220 McKee Ave., Oxford, OH 45056.

Pensate, a thinking game of evasion. The object is to get

to the top of an 8 by 8 grid while avoiding other playing pieces. All ages can play. For the II Plus; floppy disk, \$19.95. Penguin Software, 830 4th Ave., Geneva, IL 60134.

Tactical Armor Command, a game simulation of World War II in which you pick a nation, build a combat team from powerful tanks, assault guns, and tank destroyers, and command the team you've created against the enemy. For II, II Plus, and IIe; floppy disk, \$40. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Ultimaker II, a game program that allows Ultima II players to boost their character's abilities and print maps of many areas of the game. It also includes a program of playing hints that you use at your discretion. For II and II Plus; floppy disk, \$14. Amazing Software, 625 Wellington St. N, London, Ontario N6H 3E8, Canada.

Atari

Paris in Danger, a multilevel simulation game of the December 1814 campaign to crush Napoleon. When two or more enemy corps engage, combat becomes tactical on a strategic map of Western Europe. For the 800; floppy disk, \$35. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Solar Storm, an adventure game. Strapped in your laser ship, you must battle fierce aliens that approach in waves of increasing velocity. In addition, the sun explodes and showers heated fragments on your vulnerable

planet. See if you can survive. For the 2600; cartridge, \$29.95. Imagic, 981 University Ave., Los Gatos, CA 95030.

CP/M

Fallout, a fallout-prediction and shelter-design program that lets you analyze any location in North America under various attack scenarios and size a shelter for the location. This program includes an accessible database of over 1200 targets, 300 weather stations, multiple targeting, user-selectable attack cases and winds, and easy-to-understand summary outputs. Floppy disk, \$29.95. Go Software, POB 2693, Chicago, IL 60690.

Organizer II, a utility package that lets you display, explain, and execute hundreds of applications, utilities, and system functions. You can also develop your own special menus. Floppy disk, \$149. The Information People, 443 Hudson Ave., Newark, OH 43055.

Pro Pascal, a programming-language compiler that generates native machine code for efficient program execution. Floppy disk, £220. Prospero Software Ltd., 37 Gwendolen Ave., London SW15 6EP England.

Z80ASM, a Z80 assembler in manual form with complete source-code listing and a tutorial on assembler theory. Includes standard Zilog mnemonics and manual. Easily revised as a cross-assembler. Floppy disk, \$50. King Software, POB 208, Red Bank, NJ 07701.

Commodore

Casual Writer, a utility package that lets your computer function like a word processor. No need to retype your entire text, just retype those words you need to change. Information can be stored on tape and easily recalled from tape for quick review. For the VIC-20; cassette, \$29. E.N. Publications, RR 1, Box V, Worden, IL 62097.

Deadly Skies, a fast-action arcade game. You must destroy the enemy's military base, missile emplacements, and many tanks. Avoid patrols, asteroids, and tracking bombs. For the VIC-20; cartridge, \$39.95. Tronix, 8295 South La Cienega Blvd., Inglewood, CA 90301.

Dr. Floyd, an interactive game that simulates artificial intelligence. You can converse with this program in the psychoanalytical technique used in client-centered therapy. For the VIC-20; cassette, \$14.95. Apropos Technology, Suite 821, 350 North Lantana Ave., Camarillo, CA 93010.

Gold Fever, an arcade-type game. Inside an abandoned gold mine, you must collect all the gold you can before your oxygen runs out. Avoid runaway boxcars, rolling boulders, and an evil claim jumper. For the VIC-20; cartridge, \$39.95. Tronix (see address above).

The Math Teacher, an educational math-tutorial program that drills students in math from first grade through junior high school levels. It contains 25 working math problems per session and displays student's scores. For the

What's New?

ming languages on computers that do not provide bit manipulation. The file-transfer protocol is inherently half-duplex or command responsive. The hardware requirements are a 212A or 103 modem and voice-grade telephone cables.

Currently, the MNP protocol has been employed on such computers as the Apple, the Radio Shack, and the IBM PC. It has also been used in Microcom's line of networking modems. MNP is available for a \$2500 licensing fee. Full particulars can be obtained from Microcom Inc., 1400A Providence Highway, Norwood, MA 02062, (617) 762-9310. Circle 683 on inquiry card.

Database Covers Industrial-Site Development

Sitenet is a free online database delivering instant site data to industrial facility planners and corporate real estate executives. Sitenet's files contain information on tax incentives for industrial development, more than 5000 contacts in area economic development, and a directory of office and industrial parks. A new-plant file provides data on more than 1000 worldwide industrial expansion projects and details on the amount of investment, acreage, and square footage of the undertakings. An interactive inquiry mode lets you request additional information online from development corporations participating in the network.

Blocks of information provided by state development agencies, railroads, and utilities are available. Hard-copy reports from the database can be ordered.

For more information, contact Conway Data Inc., 1954 Airport Rd. NE, Atlanta, GA 30341, (404) 458-6026. Circle 684 on inquiry card.



Intelligent Communications Processor

Winterhalter's Datatalker I is an intelligent front-end communications processor for emulating such remote batch and interactive terminals as the IBM 3780, 2780, and 3276 using IBM Binary Synchronous Protocol. It contains two network programs for interactive and remote batch emulation, both of which offer full bisync emulation and on- and offline diagnostics. A communications manager assumes responsibility for controlling the line between the microcomputer and the host system. An applications program, executed on the microcomputer, acts as an interface between the microcomputer and Datatalker and allows custom user programs to interface with the host. This arrangement frees the microcomputer of

all communications overhead and overloads.

Datatalker hardware consists of one modem port, a diagnostics port, and an asynchronous serial link with internal clock generation. All ports are RS-232C serial interfaces. The modem and diagnostics ports can be programmed for internal or external clock generation and are byte or bit synchronous or asynchronous. Internal clock speeds range from 110 to 19,200 bps.

The Datatalker I is a desktop unit that weighs about 7 pounds. The suggested list price is \$995. Further details are available from Winterhalter Inc., 3853 Research Park Dr., Ann Arbor, MI 48104, (313) 662-2002.

Circle 685 on inquiry card.

Apple/Atari Interface

Prowell Computer Services markets an interface that allows disk files to be transferred between Atari 400/800 and Apple II, II Plus, and IIe computers. A cable that connects to the joystick ports on both computers provides the means for sending and receiving source programs and data files.

The interface comes in two versions. The Model 1 is designed for the Apple II/II Plus. The Model 2 includes the cable and a 9-pin connector that mounts on the back of the IIe. They cost \$75 and \$90, respectively. A 4-foot extension cable is also available. Contact Prowell Computer Services, Suite 325, 4974 North Fresno, Fresno, CA 93726, (209) 227-4917.

Circle 686 on inquiry card.

Arcnet-PC Network Controller

The ARC-PC local-area network controller board is a simplified interface between IBM Personal Computers and Datapoint's Arcnet token-passing network. Standard Microsystems' single-chip COM 9026 network controller and COM 9032 network transceiver LSI circuits handle Arcnet protocols. This single printed-circuit board has an onboard 2K-byte data-packet buffer that accommodates up to four pages of packet storage and can be dynamically defined for double-buffering of transmit and receive

Subscripts and Superscripts for the Atari

You can use ANTIC 3 mode to create specialized character sets

by Tim Kilby

The Atari computers give you tremendous flexibility in defining your own character sets and providing a practical mode in which to use them. One special mode, ANTIC 3, allows for characters with true descenders, superscripts, and subscripts. This means that you can create a specialized character set for many applications, including chemical and mathematical formulas (see listing 1).

Listing 1: This output from the ANTIC 3 Demonstration Program displays the use of lowercase descenders, superscripts, and subscripts.

```
AgNO3 + KBr → AgBr↓ + KNO3
(x2+y2)2=4(x2-y2)
READY
█
```

Starting from GRAPHICS 0

ANTIC 3 cannot be addressed directly; you must modify a GRAPHICS 0 display list to use this mode. A simple routine to do that is shown in listing 2. Run this routine and you will see that you now have 19 lines of text, each line capable of holding 40 characters. The format looks like a GRAPHICS 0 display, just spaced farther apart.

If you try displaying lowercase letters on the screen, you'll see something definitely different about this mode. In ANTIC 3, the first 2 bytes of character data are read last. (Remember, there are 8 bytes of shape data per character.)

That's right. The computer reads the third shape byte first, then the fourth, fifth, and so on. After the eighth byte, it reads the first and second bytes. This only happens for the 32 lowercase characters and symbols, characters 96 through 127.

Why, you are probably asking, this strange way to read character data? Each mode line in ANTIC 3 is actually 10 scan lines tall, unlike the 8 lines in GRAPHICS 0 mode. For all characters, except the last 32 in the set, the system prints the character using the top 8 scan lines in the stack of 10. ANTIC 3 was designed to display lowercase descenders, the tails on ys, gs, etc. So for those last 32 characters, each is printed in the unusual sequence

Listing 2: The GRAPHICS 0 Display List Modification Routine.

```
10 GRAPHICS 0
20 DL=PEEK(560)+256*PEEK(561)
30 POKE DL+3,67
40 FOR I=0 TO 17:POKE DL+I+6,3:NEXT I
50 POKE DL+24,65:POKE DL+25,PEEK(560):
   POKE DL+26,PEEK(561)
```

of bytes illustrated in figure 1. Not all the lowercase internal characters will work. With specially designed lowercase letters, however, descenders really look descended.

The quick and easy way to redesign this last quarter of the character set is to use one of the several published or commercially available character-set editors. Characters that are so tall as to have dots in the second byte, the second row from the top, will have to be lowered. The b, l, t, i, and h characters are examples. I suggest lowering all lowercase characters by using the shift-down option of your editor. If your editor doesn't have that option, you will have to do the shifting manually. Shift all lowercase characters down 1 byte.

For true descenders, redesign characters that have descenders so that the last 2 bytes to be displayed ap-

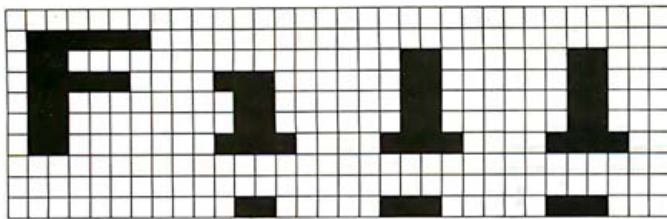


Figure 1: Some standard characters as displayed in the ANTIC 3 mode. Note that the uppercase character is unaffected while the lowercase characters are distorted.

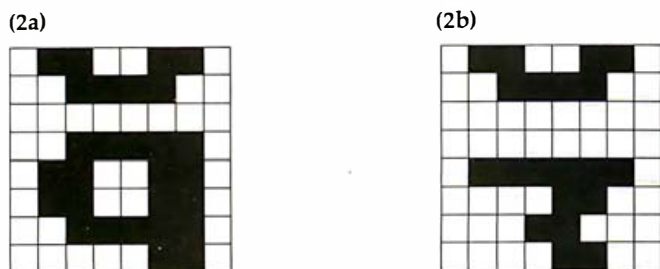


Figure 2: Redefined characters for use with the ANTIC 3 mode. The lowercase g (2a) will have a descending tail, and the 3 (2b) can be used as a subscript character.

pear as the first 2 bytes. It will look crazy, but that's what is necessary for ANTIC 3. Figure 2a shows the g character redesigned to be used for this mode.

Subscripts and Superscripts

The real power with ANTIC 3, however, is in the ability to display superscripts and subscripts. Just imagine printing chemical or mathematical equations on screen with the superscripts or subscripts just where they should be. For subscripts, simply replace the lowercase characters with numerals or other characters using your editor's copy option, or design your own special symbols. Then shift those characters 3 bytes lower for maximum descent. The number 3 would appear as it does in figure 2b for use as a subscript.

Listing 3: The ANTIC 3 Demonstration Program incorporates the routine in listing 2 to produce the output shown in listing 1.

```

5 REM ANTIC 3 Demo Program
6 REM
7 REM First relocate all 128
  characters to a RAM location:
8 GOSUB 1000
9 REM Modify the display list:
10 GRAPHICS 0
20 DL=PEEK(560)+256*PEEK(561)
30 POKE DL+3,67
40 FOR I=0 TO 17:POKE DL+I+6,3:NEXT I
50 POKE DL+24,65:POKE DL+25,PEEK(560):
  POKE DL+26,PEEK(561)
58 REM
59 REM Change character set pointer to
  the RAM location of modified set:
60 POKE 756,CADR/256
68 REM

```

```

69 REM Print equations in ANTIC 3 mode
  using new characters:
70 PRINT :PRINT "AgNO3 + KBr c AgB
  r2 + KNO3"
80 PRINT :PRINT "(x$+y$)$=4(x$-y$)"
90 END
1000 POKE 106,PEEK(106)-5:GRAPHICS 0:P
  RINT "Transferring characters from ROM
  to RAM . . . ."
1010 CADR=256*(PEEK(106)+1)
1020 FOR I=0 TO 1023:POKE CADR+I,PEEK(
  57344+I):NEXT I
1030 ? :? "Redefining 8 characters . .
  . ."
1038 REM
1039 REM Replace data for 8 characters
  - a, b, c, g, r, x, y, and $ - :
1040 FOR I=0 TO 23:READ X:POKE 776+CAD
  R+I,X:NEXT I
1050 DATA 102,60,0,0,126,12,24,12
1060 DATA 60,24,24,24,24,24,219,126
1070 DATA 24,0,24,12,6,255,6,12
1080 FOR I=0 TO 7:READ X:POKE 824+CAD
  R+I,X:NEXT I
1090 DATA 102,60,0,62,102,102,62,6
1100 FOR I=0 TO 7:READ X:POKE 912+CAD
  R+I,X:NEXT I
1110 DATA 0,0,0,124,102,96,96,96
1120 FOR I=0 TO 15:READ X:POKE 960+CAD
  R+I,X:NEXT I
1130 DATA 0,0,0,102,60,24,60,102
1140 DATA 108,56,0,102,102,102,62,12
1150 FOR I=0 TO 7:READ X:POKE 32+CADR+
  I,X:NEXT I
1160 DATA 60,102,12,56,126,0,0,0
1170 RETURN

```

Superscripts are handled differently. Replace the lowercase letters with uppercase letters, shifting them down 3 bytes also. Replace rarely used letters and the three symbols with numerals, if you wish. (Do not edit the three screen-editing symbols. Trying to print them would still cause the function to be performed.) Now the lowercase letters become the standard alphabet and all other characters will appear as superscripts.

For those of you without a character editor, the ANTIC 3 Demonstration Program in listing 3 will transfer the internal character set from ROM (read-only memory) to RAM (random-access read/write memory) and redefine several characters for a demonstration of this outstanding mode. Try it!■

Editor's Note: For more information on using Atari graphics, please consult the following articles: "An Introduction to Atari Graphics" by Chris Crawford and Lane Winner (January 1982 BYTE, page 18), "The Atari Tutorial, Part 2: Graphics Indirection" by Chris Crawford (October 1981 BYTE, page 70), and "Character Editor for the Atari" by Tim Kilby (December 1982 BYTE, page 167).

Tim Kilby (RR 1, Box 288-B, Sperryville, VA 22740), a former college professor, is now an independent microcomputer consultant.

The ATR8000

This Z80 computer/peripheral enables Atari users to run CP/M-based programs

by Dave Small and Sandy Small

Capable of serving as an intelligent peripheral or as a stand-alone computer, the ATR8000 should prove to be of interest to Atari users because it enables them to access CP/M-based applications programs. It should also prove of interest to anyone looking for a machine that can run CP/M-80, CP/M-86, or MS-DOS.

The ATR8000, manufactured by SWP (formerly Software Publishers Inc.), owes its potentially wide appeal to its availability in four configurations. The lowest-priced version (\$350) employs 16K bytes of RAM (random-access read/write memory), 4K bytes of ROM (read-only memory), and a Z80 processor. Intended to serve as an Atari peripheral, this model can readily interface Atari computers with a host of additional peripherals, including standard-bus disk drives and devices with Centronics parallel or RS-232C serial ports. When used to interface a printer to an Atari, the ATR8000 allocates a 12K-byte buffer for printer-spooling operation.

(1a)



The intermediate and two top-of-the-line configurations can serve as stand-alone computers. The stand-alone versions can interface with standard terminals such as those offered by Televideo Inc. or use an Atari computer as a terminal.

The intermediate configuration (\$550) includes a Z80 processor and 64K bytes of RAM, which makes it capable of running the CP/M 2.2 operating system configured for 60K bytes of RAM. When used as an Atari peripheral, this configuration's 64K-byte RAM can be used as an additional printer-spooler buffer area.

Each of the two top-of-the-line models (\$800 or \$1050 added to the \$550 price of the intermediate version) incorporates an 8088 16-bit processor and either 128K or 256K bytes of RAM in addition to the Z80 and 64K bytes of RAM; these configurations can run the MS-DOS and CP/M-86 operating systems, enabling the ATR8000 to handle software available for the IBM Personal Com-

(1b)



Photo 1: Front (a) and rear (b) views of the ATR8000. The rear connections shown in photo 1b are, from left to right, an RS-232C serial I/O port, a 34-pin floppy-disk connector, a 34-pin parallel printer port, and Atari serial I/O daisy-chain-out and -in connectors. A Reset button is located to the right of the daisy-chain connectors; the power connector is located directly below them.

puter. In these 8088-based configurations, the 128K or 256K bytes of RAM associated with the 8088 processor can serve as a disk emulator that can be accessed by the Z80 processor, resulting in extremely fast disk-type I/O (input/output).

The Atari Peripheral Configuration

As an Atari peripheral, the ATR8000 plugs into the serial bus that the Atari uses to communicate with I/O devices. The ATR8000 is thus daisy-chained onto this serial bus, as are all Atari peripherals. This Atari serial bus uses a nonstandard 19.2K-bits per second communications protocol. All Atari devices that use this serial bus require some sort of processor to decode or encode data out of or into this data format. For instance, Atari uses a 6507 microprocessor to perform this task in its disk drives and Model 850 interface.

Unfortunately, this added encoding/decoding-hardware requirement increases the cost of Atari peripherals. Eliminating this requirement, the ATR8000 interfaces the Atari serial bus to a number of standard peripherals. (The term "standard" here means the de facto pin-out standards that the peripheral industry has more or less adopted in the interest of compatibility.) Among the better known "standards" are the 25-pin RS-232C serial bus, the 36-pin Centronics-type parallel bus, and the 34-pin (5¼-inch) or 50-pin (8-inch) disk bus.

The first, most important peripheral is a disk drive. Up to four single- or double-sided, 8- or 5¼-inch, single- or double-density drives can be plugged into the ATR8000. Moreover, the ATR8000 permits several track formats. The range of possibilities is nearly endless, given today's drive market; the ATR8000 can use almost any drive that has the standard 34-pin bus connection used by Tandon, Shugart, MPI, and others. An adapter, available from SWP for \$19.95, interfaces the ATR8000 to units employing the 50-pin standard 8-inch drive connector used by Shugart, Siemens, and Qume.

The disk-interfacing capability alone makes the ATR8000 a good buy from the Atari owner's point of view; until now, standard disk drives, lacking the capability to decode the signals on the Atari serial bus, could not be connected to the Atari. Until recently, the only Atari-compatible drives available have been the Atari 810, a single-density unit, and a few similar drives. Because of the hardware needed for the Atari's bus, the 810 lists for \$599, which is quite steep for a 5¼-inch single-sided single-density drive.

The 810 also suffers from design and reliability problems. The first problem involves use of a serial bus to transfer data. Although the bus runs at 19,200 bits per second, the handshaking slows the effective data-transfer rate considerably. The serial bus is extremely quiet according to radio-frequency interference standards, but the data-transfer rate is four to eight times slower than that of other systems. There are also rpm-regulation and data-separation problems that reduce the 810's capability to read disks accurately.

Finally, the 810 is a single-density disk drive. As Atari and Osborne owners have discovered, the 90K-byte capacity of such drives doesn't allow much data storage, especially when compared to other double-density double-sided, 80-track drives that offer 160K to 500K bytes of storage.

A few manufacturers are marketing replacements for the 810. Other manufacturers offer disk-drive mechanisms and cases with much better reliability than the 810's mechanism. A 5¼-inch Tandon TM-100 drive with case and power supply sells for \$200 to \$250. Our experience indicates this is a very reliable drive; for instance, speed is regulated within 1 percent, a far cry from the 10 percent drift found in many Atari drives. But these "raw" drive mechanisms lack the circuitry to connect to the Atari serial bus. With the ATR8000, however, these standard drives can be driven from the Atari.

The ATR8000 offers many features in addition to disk-drive interfacing. First, it provides a Centronics parallel and an RS-232C serial port. Until now, Atari owners needing to interface to a parallel or serial device required an Atari 850 interface, which connects the Atari serial bus to these devices. The 850 retails for \$219.

Second, the ATR8000 printer port is buffered, which enables the Atari to dump data as fast as it can and go on to other things while the ATR8000 handles the printing operations. A typical 16K-byte buffer retails for \$149.

Third, the ATR8000 handles double-density disk storage of 180K bytes (assuming a single-sided 40-track drive), a significant increase over the 810's 90K bytes. Percom's dual-density disk drive for the Atari retails for \$699 (single-drive unit), or \$100 more than the Atari drive. Thus, for \$575 (\$350 for the ATR8000 and \$225 for a TM-100 disk drive with case) you're getting performance that would otherwise cost \$1067—\$699 for a Percom dual-density drive, \$149 for a 16K-byte buffer, and \$219 for a Model 850 interface.

The ATR8000 readily accommodates increases in disk-storage capacity. To upgrade to a two-drive system, for example, only a \$225 drive mechanism need be added to the ATR8000. For an Atari drive, a whole new drive plus a controller board must be added—a \$699 cost.

A New Operating System

One problem that arises when using the ATR8000 as an Atari peripheral is that the Atari's disk operating system (DOS) is not configured to handle more than 720 sectors per disk, although it can handle single- or double-density sectors (128/256-byte sector sizes). Consequently, a new operating system is needed to handle 8-inch or other high-capacity disks. SWP offers MYDOS, an operating system capable of handling these large-capacity drives. It should be noted that copy-protected Atari software and any software with a custom DOS will not take advantage of the added space of higher-capacity drives that the ATR8000 can use. But for applications that use a new DOS, the ATR8000 and MYDOS offer a helpful tool.

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At a Glance

Name
ATR8000

Manufacturer
SWP (formerly Software Publishers Inc.)
2500 E. Randol Mill Rd., Suite 125
Arlington, TX 26011
(817) 469-1181

Size
11½ by 12½ by 2½ inches; 8 pounds

Features
As an Atari peripheral, the ATR8000 interfaces the Atari serial bus to devices with RS-232C serial or Centronics parallel ports as well as to disk drives with standard bus interfaces; this version includes 16K bytes of RAM. As a stand-alone computer, the ATR8000 comes in versions with 64K to 256K bytes of RAM; a 280-based version runs CP/M-80; and an 8088-based add-on (Co-Power-88) enables the ATR8000 to run CP/M-86 and MS-DOS.

Hardware required
Interface cabling and connectors, available from SWP or other distributors

Software required
Atari DOS to use the ATR8000 as a peripheral; CP/M-80, MS-DOS, or CP/M-86 are provided with ATR8000 configurations that support those operating systems

Documentation
73 pages

Options
16K-byte 280-based version, \$349; 64K-byte 280-based version, \$550; 128K-byte 8088-based add-on, \$799.95; 256K-byte 8088-based add-on, \$1049.95; both add-ons require the 64K-byte 280-based version

Interfaces

The ATR8000 supplies Centronics and RS-232C interfaces for the Atari. Both are edge connections and accept the usual clamp-on ribbon connectors. The parallel connection runs via a flat ribbon cable to a standard 36-pin Centronics parallel-interface connector. The RS-232C connector comes out to a 26-pin edge connector that hooks via a flat ribbon cable to the popular DB-25 connector. The pin connections that have become standard for RS-232C data transmission are used: 2 and 3 for data, 4 and 5 for handshake, and so forth. If you need to swap the two pairs of lines, the ATR8000 provides an internal jumper header that allows you to change them easily.

We were pleasantly surprised to find that the ATR8000 worked the first time when connected directly to an Okidata Microline 84 (a parallel printer) and a Hayes Smartmodem (a serial device). The total interfacing took only 10 minutes, which were spent clamping connectors onto ribbon cable.

In its smallest configuration, the ATR8000 ranks as a "best buy" for Atari owners who want to expand their systems with disk drives, parallel printers, and serial RS-232C devices.

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The CP/M Configuration

The ATR8000 configured as a stand-alone computer uses the Atari as a terminal. If you do not own an Atari, any RS-232C device capable of running at 9600 bits per second will suffice. We used a Lear Siegler Inc. ADM 3A terminal for some time. You must move three jumpers in the ATR8000 depending on whether an Atari or an RS-232C terminal is used.

This configuration of the ATR8000 comes equipped with 64K bytes of RAM, 60K bytes of which are available as system RAM. A 4K-byte section is mapped into a 2732 EPROM (erasable programmable read-only memory) containing the Atari disk-emulation code and a monitor, used to boot up CP/M. CP/M 2.2 from Digital Research is supplied on either a 5¼- or an 8-inch disk.

The hardware difference between this ATR8000, a full CP/M machine, and the 16K-byte version, which is an Atari-only peripheral device, is in the memory upgrade (larger dynamic RAMs) and internal jumpers. The cost of this upgrade to an end user is \$200. Now, to a knowledgeable computer user, paying \$200 for upgrading 4116 RAM chips to 4164s ($\times 8$) seems a bit out of line. However, for that price, SWP is supplying not only the new RAM chips but also a licensed copy of CP/M, all the CP/M utilities, CP/M manuals (a thick stack), and, most of all, support.

Of course, if you still want to use your ATR8000 as an Atari interface, it will work as such in its 64K-byte configuration. The only difference is that 58K bytes, instead of 12K bytes, are available for print spooling. Unless the ATR8000 is specifically booted into CP/M, it remains an Atari peripheral.

In CP/M mode, the Atari serial bus direction is reversed, and the ATR8000 becomes a stand-alone computer; the Atari becomes a terminal instead of serving as the primary computer.

There is, however, a disadvantage to using the Atari as a terminal. The Atari's video-generator chip has a text-window resolution of 40 characters across by 24 characters high. (This format is consistent with 160 color clocks on an average TV screen; TVs do not have the bandwidth needed to run 80 characters across.) Hence, when the Atari is used as the I/O device for the ATR8000's CP/M, a 40-column screen is supported.

The system comes with software to make the Atari emulate an 80-column ADM 3A terminal with a scrolling window. With this technique, 80 characters across are maintained internally, and 40 of the 80 are shown on the text screen. The user can manipulate the window with keys and has the option of having the window follow the cursor across the screen, a rather dizzying effect.

If the Atari 800 is equipped with an 80-column video card, such as the Bit-3 Full-View 80, then true 80-column CP/M can be used. Interfacing is straightforward. Our system, for instance, has the Bit-3 board and a PI 3 monitor and functions very well. The Bit-3 board for the Atari 800 retails for \$349.95. A typical monitor capable of 80-column display costs \$150. (For details on the

80-column board, contact Bit-3 Computer Corp., 8120 Penn Ave. South, Suite 548, Minneapolis, MN 55431.)

The CP/M system is booted in a two-step process. The booting process illustrates the operation of the ATR8000 system, so let's go into it in detail.

First, turn the ATR8000 on. Any disk drives connected to the ATR8000 are restored to track 00, then stepped out five tracks. (We wondered why this was done until we found out that some disk drives can get the disk head caught behind the track 00 sensor. The five outward steps prevent this problem (an impressive "user helpful" feature). The drive's index pulses, from the index hole on the disk, are sensed and timed; if the index pulses indicate an rpm of 300, the drive is logged as a 5¼-inch drive. If the rpm is 360, the drive is logged as an 8-inch drive. Internal tables are set accordingly (for example, the single-density format command is told to place 18 sectors on a 5¼-inch track and to put 26 sectors on an 8-inch track; this boot-timing process determines which format is used).

The step rate of the drives is determined automatically at boot time, and the drives are run at the fastest rate at which they can be stepped. Because this rate varies widely between drives, automatic stepping timing is a real convenience; it makes the ATR8000 capable of using a wide range of drives without the user having to worry about step rates, settling times, and so forth, which vary so widely across the industry. If you have a drive only intermittently capable of running at high speed, however, you can force a slower default stepping speed on a particular drive by using the DDSYSGEN editor. (We had a problem with one of our 8-inch drives that has been around a long time; it could not always step at high speed, so we slowed down the stepping to the next available rate.)

Next, the ATR8000 settles down into Atari-emulation mode, in which it accepts normal Atari commands from the serial bus and executes them. For example, disk I/O requests are sent to the proper drive, printer requests are sent to the printer, and so on.

At this point, the ATR8000 is usable as an Atari disk drive. Next, let's boot CP/M.

Let's assume you have put the Autoterm-ADM 3A Emulator disk in the ATR8000's drive 1 and started up the Atari. Acting as an Atari disk drive, the ATR8000 reads in the emulator and sends the program to the Atari. The Atari then starts acting as a terminal, "watching" the serial bus for communications. At this point, the serial bus is turned around; the ATR8000 is the primary computer and the Atari is the terminal.

The ATR8000 is reset by the user via the back-panel Reset button, which sends it out of Atari disk-emulation mode. The ATR8000 displays the message ATRMON, which indicates that the system is running a small monitor, in ROM, in the ATR8000.

At this point, you're just about ready to run CP/M; remove the Autoterm-ADM 3A Emulator disk and insert any disk with the CP/M operating system into drive 1 (A). Next, type in B. This command initiates the boot

process from drive 1. In 2 or 3 seconds the familiar 60K CP/M 2.2 and A> messages appear on the Atari's screen.

If you are running with a terminal other than the Atari, the CP/M boot process is a single step; you put the CP/M system disk into drive 1, switch on the ATR8000, type in B, and boot directly. The difference is in using the ATR8000 to load the Atari's terminal program.

What is so impressive is the ease of this whole process. The ATR8000 determines drive size, density, sector size, and so forth, by itself, with no user intervention. You do not need to keep the system on a 5¼- or an 8-inch disk, nor do you need to permanently keep one kind of drive as A. Furthermore, programmers at SWP have allowed the use of 1024-byte sectors, which are internally deblocked to eight 128-byte sectors. The use of 1024-byte sectors is extremely efficient; in a 1024-byte disk format, most of the track is taken up with the data, not a number of sector headers and other non-data overhead. This format, by minimizing disk accesses,

The ATR8000 determines drive size, density, sector size, and so forth, by itself, with no user intervention.

speeds everything up. In a typical input or output operation, another disk access is not needed until all 1024 bytes are processed. This compares with eight disk accesses on a single-density, 128-byte-sector (standard CP/M) system.

Because of the lowered amount of sector header information, the 1024-byte-sector format is recommended. This format fits 180K bytes of data on a 5¼-inch disk and 674K bytes on an 8-inch disk, assuming double density. If you use double-sided drives, the capacity increases to 360K bytes on a 5¼-inch drive and 1.3 megabytes on an 8-inch drive.

From CP/M, many disk-track-layout formats are available, in either 5¼- or 8-inch disks:

- 128 bytes/sector, single density (the standard 8-inch disk format)
- 256 bytes/sector, double density (a common double-density format)
- 512 bytes/sector, double density (suitable for reading TRS-80 Model II 8-inch disks)
- 1024 bytes/sector, double density (the usual SWP format, allowing 674K bytes of storage on a single-sided 8-inch disk)

SWP's DDINIT program initializes a disk to any of these configurations, and the software automatically adjusts for the new sector sizes.

The ATR8000 can read disk formats of several manufac-

turers, including those of IBM, Kaypro, Osborne, and the Xerox 820. Configuration programs are available to read disks with nonstandard interleaving or sector size. We found these programs extremely useful; we had a library of Osborne disks, with their 90K-byte limit, and data spread across those disks that we wanted in one place. We copied about 30 Osborne disks down to three double-density 8-inch disks and had room to spare.

If you change disk density or sector size with a disk swap, a simple Control-C command will reset the ATR8000's internal tables, and upon the next disk access to the drive involved, the ATR8000 will reconfigure itself and the CP/M blocking/deblocking tables for the proper density and sector size.

We ran one rather unfair test of the ATR8000 just to see how far the software would go. We formatted a disk with half double-density and half single-density tracks on it and then started copying programs onto it. The system reached the track with the changed density; once the system "found" the new density areas on the disk, it reset the internal tables and continued writing. At this point, we gave up trying to find ways to beat the ATR8000.

Our ATR8000 system has two 8-inch Shugart 800 drives and one 5¼-inch Tandon TM-100-1 drive. Operation under CP/M and Atari DOS has been flawless. Any number of copy operations from 5¼- to 8-inch and vice versa, density changes, and strange disk formats have

operated with no problems. In other words, the ATR8000 disk firmware has been thoroughly debugged.

The CP/M software we've used with the ATR8000 includes Wordstar, Microsoft BASIC, Supercalc, and SMODEM37. All have performed without any problems. There is probably no CP/M system on the market that is easier to use. For instance, take the automatic drive configuration. When the ATR8000 is booted, it determines drive and sector size, density, and step rate automatically.

For most CP/M users, these things do not happen automatically. Most of them must be done by (usually) modifying the CP/M BIOS (basic input/output system), which involves editing and reassembling source code—no small task for a novice user. Generally, the user must configure the floppy controller-board software for drive step rate, size, number of tracks, and so on. The user must also configure CP/M for sector and disk size, setting up a number of tables for each new drive. Frankly, this is a miserable process and tedious even when you have been through it before; for a beginner, just understanding the CP/M parameter tables is nearly impossible.

But the ATR8000 does all of this automatically. We have changed drive configurations and densities many times and never once touched the BIOS. Because you can hook up almost any disk drive and use the drive without problems, the ATR8000 may be an ultimate CP/M system.

If you need a low-level disk analyzer, SWP offers Diskmon and supplies it to every CP/M customer. This sector-level disk editor is helpful for recovering data from bad disks and for fixing directories. SWP also supplies SMODEM37, a user-friendly telecommunications program configured for the Hayes Smartmodem and the ATR8000. (SMODEM37 is a public-domain program developed by the prolific Ward Christiansen and the CP/M User's Group.) We have used it for some time with CompuServe, The Source, and many bulletin boards and found it to be an excellent and friendly modem program. Such features as checksummed object-code transmission and reception, printer on/off, and a variety of data-transmission rates make it a powerful and useful tool.

The vendor documents all of these utilities in a well-written 70-page manual that also covers the parameters needed for the context editor and how to hook the system up to various disk drives. SWP also sends updates to its customers, and some errors in the manuals have been corrected. In general, the documentation is above average.

The 8088 Configuration

Internally, the ATR8000 is a standard 4-MHz Z80 system. A Mostek Z80 is the central processor, and 64K-bit or 16K-bit dynamic RAMs are used for memory. The other major chips include the standard Z80 CTC and the Western Digital 1797.

With the advent of the IBM Personal Computer (PC), the 8088 suddenly became a very popular processor. Because IBM is selling so many PCs, there is a great demand for 8088 software, and already many of the



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Photo 2: The Co-Power-88 main processor board, mounted on the ATR8000's bottom tray.

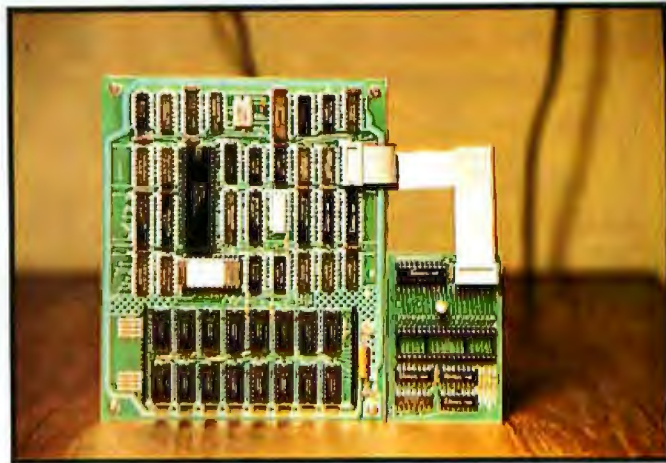


Photo 3: The Co-Power-88 main processor board and Z80 adapter board.

popular applications programs for CP/M-80 have been translated for the 8088 (Wordstar-86, Supercalc, and others). With this potentially large software market in mind, SWP developed the Co-Power-88 (photo 2), a stand-alone 8088 processor with either 128K or 256K bytes of memory, accessible through the ATR8000's own Z80. The 8088 is clocked at 5 MHz and runs under either MS-DOS from Microsoft or CP/M-86 from Digital Research.

The Co-Power-88, designed to provide Z80A-based CP/M 2.2 systems with the power of the 8088, plugs into the Z80's socket via a piggyback scheme. The Z80 is first removed, then an adapter (photo 3) is plugged into the Z80's socket and the Z80 is plugged into the adapter. The adapter gives the Z80 two new I/O ports, located at FE and FF hexadecimal, although the port locations are reconfigurable if those locations are already in use on your system. These two ports are then led via a short cable to the 8088 board; all communications between the 8088 and the outside world are through this cable.

This generic method of interfacing an 8088 to a Z80 can be applied not only to the ATR8000 but to many other Z80 systems. Given the number of users who will want to upgrade their Z80 systems to the 8088, this technique seems like an excellent way to go. SWP is planning on releasing the Co-Power-88 for a variety of Z80A-based CP/M machines in the near future and will probably sell a generic version for users wanting to install an 8088 themselves.

The CP/M-80 system runs normally with the Co-Power-88 installed. However, 120K or 250K bytes of Co-Power-88 RAM can emulate a disk drive, a very useful capability for spreadsheet manipulation, database sorting, and skimming through documents with Wordstar. This M-drive, as SWP refers to it, removes disk access delay time and greatly speeds up the CP/M system.

The Co-Power system is easy to boot. When "Z88 (return)" is typed, the 8088 seizes control of the user's CP/M system and boots off the main disk. The user's Z80

BIOS, and the Z80 as a controller, are used for input and output to the 8088. Hence the Co-Power-88 system is machine-independent because it uses the CP/M BIOS already written and containing the machine-dependent routines for all of its I/O functions.

CP/M-86 is available with the Co-Power-88 through SWP. Programs that run on the IBM PC should work with the Co-Power-88 if they don't rely on IBM-dependent features (direct ROM calls and so forth).

The Co-Power-88 is an excellent upgrade to CP/M-80 systems using a Z80 processor. It installs easily because it uses the CP/M routines already written. For users needing the large address space of the 8088 and who already have a CP/M-80 based system, the Co-Power-88 is well worth looking into.

Conclusion

The ATR8000 offers three levels of expansion. For the Atari, it provides a clean interface to disk drives, printers, and serial devices; for an Atari user or for any user with a terminal, it provides access to the CP/M marketplace's vast software supply and it offers the capability to access the growing 8088 software market.

The ATR8000 offers another form of expansion: future compatibility. The Atari's 6502 is an 8-bit processor in an increasingly 16-bit world. With the ATR8000, an Atari owner can begin to use CP/M-86, MS-DOS, and 16-bit 8088 software now.

A fine CP/M machine with extremely user-friendly disk interfacing, the ATR8000 is ideal for CP/M users who want to get their systems running without problems. It is a true turnkey system—one of the very few we have encountered. The ATR8000 closes the gap that has separated Atari owners from the rest of the software market. ■

Dave and Sandy Small (11314 Yucca Dr., Austin, TX 78759) are computer consultants. Both have degrees in computer science from Colorado State University.

Software Received

Top. He now faces the toughest challenge of his career: an audition that requires perfect timing on the trampolines and courage to swing across the trapeze with fire at his feet. Grinning pumpkins and pounding hammers are out to smash Sammy's dream. For II, II Plus, and IIe; floppy disk, \$37.79. Sierra On-Line Inc. (see address above).

Speedstat 2, a statistical-analysis program that provides an easy means for getting edited or raw data in and out of the system in the form of printed statistical reports or reusable data. For the II; floppy disk, \$299. Softcorp International, 229 Huber Village Blvd., Westerville, OH 43081.

Stellar 7, a strategy arcade-type game in which you are in command of the Agrav Unit, Raven. You must reach

the Arcturan star system and destroy the Supreme Overlord of the Empire, the infamous Gir Draxon. If you survive the onslaught of Arcturan forces on seven star systems, a Warplink will appear and transport you to the next star system. For II, II Plus, and IIe; floppy disk, \$34.95. Software Entertainment Co., 537 Willamette St., Eugene, OR 97401.

Wine Connoisseur, a cellar-inventory program that also files your tasting notes on flavors, aromas, vintages, and regions. This program enables you to pick the appropriate wines for meals using screen prompts and multifield search. For II Plus and IIe; floppy disk, \$39.95. Craftsbury Software Inc. (see address above).

Wings Out of Shadow, an arcade-type game based on a

science-fiction story by Fred Saberhagen. You command a spaceship that must fight four levels of a fleet of Berserkers: Bridge Game, Maze Game, Flight Deck, and Last Battle in which you must eliminate all Berserkers or distract them until the *Hope* escapes. For the II Plus; floppy disk, \$34.95. Jim Baen Inc., 8 West 36th St., New York, NY 10018.

The Witness, an interactive-whodunit game. As a chief police detective during the 1930s, you must solve your toughest case to date: a sordid family affair that could put everyone from the heir to the butler in jail. See if you can untangle the knot of motives and alibis and solve the case in less than 12 hours. For the II; floppy disk, \$49.95. Infocom Inc., 55 Wheeler St., Cambridge, MA 02138.

Zaxxon, an air-battle simulation game. As the pilot of a fighter spacecraft, you must destroy a deadly armored robot by skillfully maneuvering to attack enemy installations and fuel tanks. Avoid the enemy's barrage of missiles and gunfire as you scale walls and navigate through force fields in the three-dimensional battlefield. For II, II Plus, and IIe; floppy disk, \$39.95. Datasoft Inc., 9421 Winnetka Ave., Chatsworth, CA 91311-9969.

Atari

Astro Chase, an arcade-type game. As an ace space soldier you must save Earth from destruction by eliminating mines that threaten humanity. Avoid attacks from a variety of enemy fighters trying to distract you. For 400/800 and 1200; cartridge,

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Software Received

\$40. Parker Brothers, 50
Dunham Rd., Beverly, MA
01915.

Beneath Apple Manor, a fan-
tasy game simulation. You
play the role of an adven-
turer, exploring a multilevel
underground maze of cor-
ridors, rooms, and secret
passages to kill monsters and
find treasures. Increase your
skills in each level with color-
ful high-resolution graphics.
For the 800; floppy disk,
\$29.95. Quality Software,
Suite 105, 6660 Reseda Blvd.,
Reseda, CA 91335.

DOS-MOD, a modification
and enhancement program.
Atari DOS 2.05 now includes
full use of the screen, one-
line commands, command-
file capability, options to con-
trol wild-card file operations,
and a reliable memory/disk
swapping facility. For the
400/800; floppy disk, \$35.
Eclipse, 1058 Marigold Court,
Sunnyvale, CA 94086.

Excalibur, a medieval simula-
tion game. Based on the
legend of King Arthur, you
must govern a nation wisely
using economics, diplomacy,
magic, military strategy, even
the loyalties of friends and
enemies. An Atari joystick
controller is required. For the
400/800; floppy disk, \$29.95.
Atari Program Exchange,
1265 Borregas Ave., POB 427,
Sunnyvale, CA 94086.

Fathom, a subterranean res-
cue-mission game. You must
locate three pieces of Nep-
tune's trident to free his mer-
maid daughter from her un-
derwater prison. You can
switch from a dolphin form
to a seagull to search both sea
and sky for the missing
pieces. Learn to make magi-
cal stars and starfish to help
you in your mission. For the
2600; cartridge, \$29.95.
Imagic, 981 University Ave.,
Los Gatos, CA 95030.

Kaboom, an arcade-type
game. You are after the Mad
Bomber, a scowling convict
who roams the rooftops
dropping bombs with lighted
fuses. As you maneuver
water buckets to try to catch
the falling bombs, you are ac-
companied by the music of
the 1812 Overture. For 400/
800 and 1200; cartridge,
\$34.95. Activision Inc., 2350
Baysshore Frontage Rd.,
Mountain View, CA 94043.

Moon Shuttle, an arcade-
type game. As the pilot of a
Moon Shuttle flight, you re-
peatedly encounter unex-
pected dangers as you blast
your way through asteroids
and bomb launchers while
the enemy skillfully dodges
your sights. For 400/800 and
1200; floppy disk and cas-
sette, \$29.95. Datasoft Inc.,
9421 Winnetka Ave., Chats-
worth, CA 91311-9969.

Moonsweeper, an arcade-
type adventure. You must
reach and rescue miners
stranded on hostile moons in
an outerspace quadrant.
Avoid a deadly photon torch,
space bullet showers, and
Aurora flare activity at lethal
levels. Land on as many
moons as you can while you
rescue the miners. For the
2600; cartridge, \$30. Imagic
(see address above).

Murder on the Zinderneuf,
an adventure mystery game
in which you pick one of
eight detectives and try to
solve the mystery of the Zin-
derneuf blimp before it
lands. If you fail, someone
will get away with murder.
The mystery changes with
each different detective. For
400/800 and 1200; floppy
disk, \$40. Electronic Arts,
2755 Campus Dr., San
Mateo, CA 94403.

The Official Frogger, an
arcade-game adaptation. You
are a frog with seven lives
who must get home safely.

You must cross the freeway while cars, trucks, and bulldozers are traveling at various speeds. After you try to jump across the freeway to the safety barrier, you must navigate the river by leaping on logs and jumping on turtles' backs. For the 2600; cassette, \$18. Starpath Corp., 2005 De la Cruz Blvd., Santa Clara, CA 95050.

Operation Whirlwind, a WWII strategy game. You command a reinforced infantry battalion. Your job is to infiltrate enemy lines, destroying any resistance you encounter. The computer's forces harass you as you try to seize the city and hold it against counterattack in a limited amount of time. For 400/800 and 1200; floppy disk, \$39.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Orc Attack, a medieval-battle game. Save the castle from an Orc attack by hurling rocks and boiling oil from the parapet. Watch out for the sorcerer that is lurking in the background waiting to cast evil spells. For 400/800 and 1200; cartridge, \$39.95. Thorn Emi Home Video, 1370 Avenue of the Americas, New York, NY 10019.

O'Riley's Mine, an underground adventure game. As Timothy O'Riley, you must travel down through your mine to capture buried treasures and return home safely to the top of the mine shaft. Avoid hungry river monsters and drowning in the rushing water. Use your dynamite carefully to destroy the monsters without destroying yourself. For 400/800 and 1200; floppy disk and cassette, \$29.95. Datasoft Inc. (see address above).

Q Bert, an arcade-type game in which you hop Q Bert down a pyramid of cubes

that change color with each successful landing. All the cubes must be changed to the same color before the player can move on to the next, more hectic round of play. For 400/800 and 1200; cartridge, \$40. Parker Brothers (see address above).

Rabbit Transit, a fast-action arcade-type game. As a rabbit, you must get through the mysterious meadow and the land of ledges before you can start a family. Avoid meadow meanies who try to prevent you from reaching the turtle that will carry you down the river. For the 2600; cassette, \$18. Starpath Corp. (see address above).

Super Cobra, a high-altitude arcade-type game where realistic missiles explode around you. The enemy base can be reached only by helicopter and the pilot must execute hairpin aerial maneuvers through a constantly changing terrain of mazes, caves, and cities with tall buildings, while under attack by missiles, meteors, tanks, and flying saucers. For the 400/800; cartridge, \$40. Parker Brothers (see address above).

Wavy Navy, an arcade-type game. You pilot a PT boat being tossed by 30-foot waves while surrounded by enemy bombers and kamikaze fighters that appear on the horizon backed up by helicopters with blazing machine guns. For 400/800 and 1200; floppy disk, \$34.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

The Witness, an interactive-whodunit game (see description under Apple). Infocom Inc., 55 Wheeler St., Cambridge, MA 02138.

Worms, a two-dimensional grid game. You are in control of electronic-light lines that

geometrically resemble worms. They capture territories by laying trails from dot to dot. You can choose from five worms with varying capacities. For the 400/800 and 1200; floppy disk, \$35. Electronic Arts (see address above).

XBASIC, a machine-language program to expand the power of Atari BASIC by adding 30 new functions that include string arrays, multi-color characters, player-missile graphics, and more. For the 400/800; floppy disk, \$29.95. Superware, 2028 Kingshouse Rd., Silver Spring, MD 20904.

CP/M

ACPs, a series of Access Control Programs that interfaces with CP/M 2.2, reserving system-access for authorized users. Access to a system's resources (data and program files, peripheral equipment) is also user-specific. Handles log-on/off from multiple direct-cabled and dial-up terminals and includes a manual. Floppy disk, \$150. Grover Software, POB 34216, Bethesda, MD 20817.

The Champion, a complete CP/M 2.2 accounting package written in dBASE II that includes general ledger and financial statements, accounts payable and purchase order, inventory, payroll, and accounts receivable with order entry and point of sale. This program eliminates the need for batching or sorting data and features a help function and automatic recovery in the event of a crash. Floppy disk, \$195. Data Base Research Corp., Suite 155, 66 South Van Gordon St., Lakewood, CO 80228.

Grafprn, a utility program that lets you print high-res-

olution graphics files on dot-matrix printers. It calculates all the dots on the line between the endpoints and passes this information to the printer (rasterization). This program is limited to Tektronix Plot 10 graphics information. Floppy disk, \$29.95. Micromaster Computer Consultants, 20877 Southwest Winema Dr., Tualatin, OR 97062.

Home Word Processing Service, a start-up kit. This program shows you how to start up a small word-processing service. It includes sample marketing, operating, and start-up plans, a manual, and a collection of pamphlets on such topics as legalities. Floppy disk, \$29.95. South Bay Word Processing, Suite 290, 1558 Oro Vista Rd., San Diego, CA 92154.

Starburst, a systems-building and database management tool for the nonprogrammer that unites Micropro programs or links other software programs to perform ordinary office tasks. This program lets you build and create the menus you need. Floppy disk, \$195. Micropro International Corp., 33 San Pablo Ave., San Rafael, CA 94903.

Commodore

Arcadia Mania, a fast-action arcade-type game in which you shoot nineteen waves of menacing aliens that are all out to get you. Try to kill as many as possible with your limited supply of ammunition. The more you hit, the higher your score. For the 64; floppy disk, \$24.95. Perseus Programming, 9311 Avery Rd., Broadview Heights, OH 44147.

David's Midnight Magic, a fast-action electronic-pinball game. See how high your

tems and Software, devoted to combining voice and data communications, features a special report on that subject. In addition, many advertisements feature devices that handle both voice and data transmissions.

The magazine can be obtained from Hayden Publishing Company Inc., 50 Essex St., Rochelle Park, NJ 07662. Subscriptions are offered free of charge to qualified subscribers, and single issues can be obtained at \$4 each. . . . Steve

Ukrainian Word Processing

Dear Steve,

In addition to doing word processing in English, I am looking for a computer with which I could do word processing in Ukrainian as well. I wrote to you since my problem with foreign-language character generation might best be solved through hardware. While there are software programs for various character generators, I still haven't found one with which it is possible to do word processing. C. Kenneth Fan, for example, had an article, "An IBM Character Generator," in the January 1983 *Creative Computing*. His program requires at least 96K bytes of ROM for work space—whereas this space is also used by some of the more powerful word-processing programs.

I plan to get a microcomputer in the near future, and I want to know if there is a computer on the market that supports foreign-language character sets. Ukrainian uses the Cyrillic alphabet, so I need a complete character set and not just accents and a few special characters. Do you know of any monitor with a user-definable character set? The Epson QX-10 changes its character set from normal to bold or italic; I sup-

pose that this is done through an alternate character generator. Wouldn't it be possible to do the same thing with another alphabet?

I already have an Olympia ES105 KRO electronic typewriter with a general-purpose interface that can be set for either serial or parallel operation. I also have a Russian print wheel that I am going to convert to Ukrainian.

Please let me know which computer you think would be easiest to work with. If you have any suggestions or ideas, I would appreciate your advice.

Thank you.
(Rev.) Maxim M. Kobasuk
Glen Cove, NY

The Victor 9000 computer has a software-generated character set that is loaded when the system is first initialized. Utilities are available for creating characters interactively and for installing them in an operating system. This feature will allow you to create whatever character set you desire. Since it is a one-for-one substitution, it should not affect the word-processing program.

Apple II, Atari, and other computers with graphics capability can create alternate character sets in software but must be patched into your existing word-processing program in order to be effective for screen display.

Additional information on the Victor 9000 can be obtained from Victor Business Products, 3901 North Rockwell St., Chicago, IL 60618. . . . Steve

Macro Micro Display

Dear Steve,

I am looking for a means of either projecting a black-and-white video-display image using rear-screen projection or implementing a light-dis-

play system similar to those used in stadium scoreboards. I would like to interface my IBM PC to the system to provide real-time display information at conferences and conventions.

Requirements for the system include character heights of not less than 6 inches, a maximum cost of \$500, and high visibility in a well-lit environment. Any suggestions? Thank you.

Bert Whittier
Melrose, MA

Electrohome Electronics manufactures a projection TV monitor that can be driven by any microcomputer. This would seem to be the simplest solution to your problem; however, I prefer not to quote its cost. Call or write them for additional information at Electrohome (U.S.A.) Limited, 182 Wales Ave., Tonawanda, NY 14150, (716) 694-3332. . . . Steve

Atari Parallel Interface

Dear Steve,

I've heard rumors that a printer interface can be built for Atari personal computers by using the number 3 and 4 controller jacks, and that a company is producing such a product. So far, however, I have been unable to locate any such company.

Do you have a schematic or know of anyone who is familiar with such an interface? I assume the interface is serial, but is a parallel interface possible using the controller ports? Thanks.

Ron M. Yoakem
Bainbridge, OH

Macrotronics makes a product that will enable the Atari 400 or 800 to drive a parallel printer through the front controller connector, without the need for the Atari 850 or a similar interface.

A short driver program directs all LPRINT commands to the parallel-printer interface. It is compatible with BASIC, DOS, and ASSEMBLER/DEBUG. The address is Macrotronics Inc., 1125 North Golden State Blvd., Turlock, CA 95380, (209) 667-2888. . . . Steve

Math Language

Dear Steve,

I am having trouble finding a microcomputer language that handles complex arithmetic. As I am currently changing systems, the available languages will have some effect on what I purchase. I'd appreciate any help you can provide.

Stuart Sands
Berkeley, CA

FORTRAN IV has a COMPLEX function, but it is not implemented on microcomputer versions. I have been told by a professional programmer that the mainframe implementation is so slow that he writes his own routines; it is not very difficult. All that is necessary is to compute the real and imaginary parts separately, and then add them. This may be the easiest solution to your search. . . . Steve

Scope Your Data

Dear Steve,

How can I determine the data rate, parity, and stop-bit characteristics being transmitted by a computer over an RS-232C port by examining these signals on an oscilloscope?

Chuck Gollnick
Pullman, WA

Determining the data rate of a data signal by using an oscilloscope is very easy. Send a series of characters with lots of "ones" in its binary code. The question mark (?) is hexadecimal

Pinball Construction Set

*Build your own pinball game on
an Apple II, Atari 400/800/1200, or Commodore 64*

by Elaine Holden



Photo 1: The title picture for the Pinball Construction Set. This is an example of the type of graphics a player can create. Note that this software was originally published by Budge Company but is now also available from Electronic Arts.



Photo 2: *Astro Blast*, one of the demo games that come with the system and are ready to play.

Attention, pinball wizards! As you well know, those big arcade machines with flashing lights and ringing bells have long been a fascination to those of us wishing to exhibit skill, dexterity, and some evidence of a mis-spent childhood. Now, thanks to the Pinball Construction Set from Electronic Arts (photo 1), not only can you play pinball in the comfort of your own home, you can also design your own pinball game. Other pinball-simulation games have been available for some time now, but this is one of the first games that lets you build other games.

If you need a game fix immediately after purchase, you can just boot the disk and play one of the five demonstration pinball games available (see photo 2). They are set up for as many as four players, so you can play alone or with friends. After this initial introduction, and once rational thinking has returned, you can reach for the user's guide and discover how much more exciting this construction set can be.

Building a Dream Game

One of my fantasies as a pinball player has always been to build my own game—one to suit my mood. At times I want the toughest challenge going, but once in a while I like a real pushover, and sometimes I even like an honest game. The variety of my requirements is endless, but, until now, the variety of available pinball games was not.

With the Pinball Construction Set, I can make any game I want, save all my quarters, and exercise my creativity at the same time. This game enables a complete novice to put together a worthwhile beginning game, gain experience, and later devise a devilishly tough, highly competitive game.

Just as in any construction kit, all parts are provided. Each piece of the pinball game is represented by a picture. These pieces can be placed anywhere on the empty pinball board (photo 3). All parts are activated and dragged onto the board by a movable hand symbol. This



Photo 3: A pinball game being constructed. Note the menu of game parts on the right half of the screen and the column of icons along the right edge of the screen.

symbol, as well as everything else in the game, is controlled by the joystick.

The Hand is one of a number of icons (pictures) that represent the various functions the program can perform. For example, you work with an icon that looks like a disk to save or load a game. These icons make it easy for a beginner to use the program.

If you want a different shape for a game board, the Arrow, Scissors, and Hammer icons can create and change solid shapes. These are very powerful commands because you can change not only basic shapes within the game's parameters but also the actual shape of the board. (Traditional arcade pinball games, of course, do not offer this option, and I've become bored with the same rectangular shape.) My favorite game creation so far has a pentagonal shape with lots of bumpers and few flippers.

Lest you imagine that the various shapes and games must remain the same color, take heart. A Paintbrush icon instantly changes the color of the game border or the shapes within. (For small shapes there is even a Magnifier icon). If you have a particularly nasty streak, when constructing a game for friends, you can paint over a bumper or other pinball part. It will still be there, you understand, it just won't be visible. To carry this trick one step further, you can paint in what looks like a bumper or paddle, and when the ball falls through the fake part, watch your opponent's face drop.

I also enjoyed personalizing my game with fancy decorations and a nifty title. For this I used the Magnifier icon (photo 4). It takes a little time and patience to perfect this icon's uses. Seeing a part of the screen magnified seven times its usual size takes some getting used to. Persistence is rewarded, however, by some really fine designs and lettering.

I had everything I needed for the perfect pinball game at this point—or so I thought. Then I turned the page of my manual and found the World icon. This feature gives four scales which change the conditions of the ball.

Gravity determines the weight of the ball; Speed governs how fast the ball moves; Kick is the strength of the bumpers; and Elasticity reflects how much bounce is wanted in the game.

The last icon worthy of note is the And gate. An And gate in computer science is a switch arrangement that permits an electrical flow only if all switches in the gate are on. The And gate in the Pinball Construction Set, functioning along the same principle, lets you record a bonus only if all the targets you have hooked together have been hit and turned on. Pretty fancy stuff. This icon also lets you change score values and sound. You can even have the beloved sounds of bells and whistles right at home.

Something for Everyone

I found this to be an incredibly complete kit. Bill Budge, the creator of this package, has a marvelous sense of programming. From the standpoint of an instructor of computer programming, I can only say, "Wow! I wish I wrote that." From the basic concept to the refined details, this is indeed a classy game.

The crowning feature of the Pinball Construction Set is its simplicity. A novice or young child can play a demo game to learn pinball basics. Nevertheless, for adult or child, it needn't remain just a game. Players can exercise creativity with color, shape, sound, relativity of weight and speed, and detail, all with this one program. As expertise increases so does the quality of the games created. Moving at the individual's pace, this non-

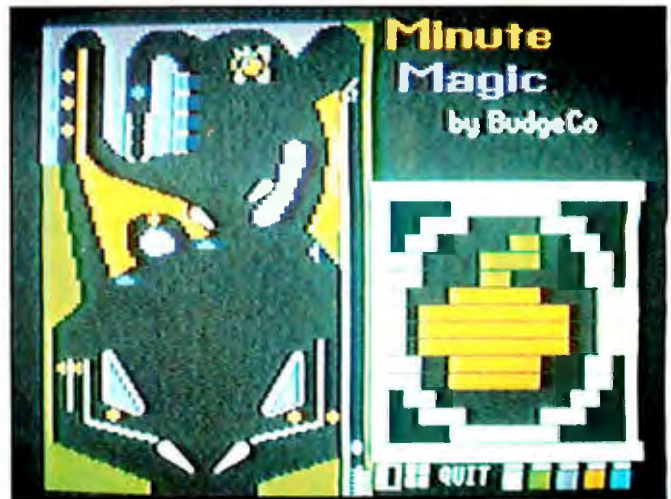


Photo 4: An example of how the Magnifier icon is used. The figure on the right is a seven-times magnification of the apple in the upper-right corner of the game board.

threatening program records work done and provides for easy correction and alteration.

Despite this simplicity, sophisticated adult players will also be impressed with the game. It can be difficult enough for even the most advanced player because of the challenge and endless variety of modifications, refinements, and degrees of difficulty available. I predict that this program will be a continuing favorite in many personal game libraries.

I should note that you can also use this program to make gifts for gaming friends. Pinball games of your own creation can be put on blank disks and given away. You can design each game with the recipient in mind, and since up to 128 parts can be on the board at once, hardcore pinball players should remain fascinated for a long time.

Conclusions

It's really hard to find anything wrong with this game. The concept is well designed and executed. The instructions needed to begin the game are minimal, and game playing is immediate and, in the case of novices, instructional. Experienced players can gain valuable tips from the more difficult samples such as DEMO4 and DEMO5 (which illustrate some common obstacles such as a corner of the game where a ball could get stuck).

Creativity is encouraged. At the same time, players are not threatened or intimidated by either the screen display or the user's guide. Rather, they are gently encouraged and aided. This is valuable for children and inexperienced players and computer users.

I certainly feel that the Pinball Construction Set is valuable both as a learning and creating tool and as a truly entertaining game. ■

Elaine Holden is the supervisor of reading and language arts for the Merrimack, New Hampshire, School District. She can be reached at 22 Elm Street, Peterborough, NH 03458.

At a Glance

Name

Pinball Construction Set

Type

Software to play and/or construct a variety of pinball simulation games

Publisher

Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
(415) 571-7171

Price

\$40

Format

5¼-inch floppy disk in Apple II, Atari 400/800/1200 or Commodore 64 formats

Documentation

13-page users guide

Computer Needed

Apple II, Atari 400/800/1200, or Commodore 64; joystick required

Audience

Ages 10 and up; pinball lovers, game players, creative people, and teachers of gifted and talented children

be stored. It will verify disks in 12 seconds. For II Plus and IIe; floppy disk, \$28.95. Jagware, 127 Albany Ave. SE, Orange City, IA 51041.

The Spy Strikes Back, a high-resolution graphics game in which you must locate Dr. X's terrorist operation. Reports reveal that each of the five floors in his hideaway is divided into 24 guarded sections, containing 16 rooms. The object is to get through these rooms without being seen or getting caught. For the II; floppy disk, \$19.95. Penguin Software (see address above).

Stockfile, a stock-control program for smaller businesses. You can store up to 1000 stock lines on one disk. Using extra disks, up to 30,000 stock lines can be created, viewed, updated, corrected, or printed. It automatically calculates stock values. For II and IIe; floppy disk, \$95. Felix Software, 19 Leighton Ave., Pinner HA5 3BW, England.

Super Disk Labeller, a machine-language utility package. Prepare and print floppy-disk labels that organize your disks into a library. This program allows use of a variety of printers using the printer configuration mode and lets you print labels of almost any size with the label-options mode. Requires Applesoft in ROM. For II, II Plus, and IIe; floppy disk, \$34.95. Lakefront Software, 7754 Balboa Blvd., Van Nuys, CA 91406.

Talk-U-Thru Wordstar, a step-by-step tutorial program to teach the functions of Wordstar. This program features an introduction to CP/M, Wordstar installation, cursor moves, text moves, deleting and inserting text, on-screen formatting, file-man-

agement techniques, and a variety of other functions. Includes audiocassettes covering installation, cursor moves, and formatting and printing. For II, II Plus, IIe, and III; floppy disk, \$49.95. Talk-U-Thru Tutorial Systems, 6519 Fountain Ave., Los Angeles, CA 90028.

Teacher's Pet, a report-card program that can keep track of an unlimited number of students ranging from elementary to high school. Up to 800 objectives can be placed on the master disk, which already contains about 700 standard objectives. For II Plus and IIe; floppy disk, \$300. Softcell (see address above).

Atari

Computer Football Strategy, a football-simulation game similar to the board game. Pit your strategic skills against the computer or a live opponent as you call both offense and defense plays. Many formations to choose from as the game clock ticks away. For 400/800; cassette, \$16. Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

The Arcade Machine, a game-creation program. Develop your own animated creatures, spaceships, aliens, tanks, monsters, or other objects to move over a variety of backgrounds. Include such sounds as explosions, musical tones, and other sound effects as you design your own arcade games. For 400/800 and the XL series; floppy disk, \$59.95. Broderbund Software Inc., 17 Paul Dr., San Rafael, CA 94903.

B/Graph, a professional graphics-charting and statistical-analysis program. You can assemble, process, and

display complex, extensive numerical data in graphic form with this comprehensive, two-disk package. For 400/800; floppy disk, \$99. In-home Software Inc., Unit 8, 2485 Dunwin Dr., Mississauga, Ontario L5L 1T1, Canada.

CP/M

Billchecker, a personal financial program that runs CP/M 2.2. This lets you handle check writing and bill paying. When you categorize bills due, their dates due are automatically updated. Checkbook will hold up to 200 transactions with six-digit numerals using double precision. Floppy disk, \$39.95. Extal Alstar Inc., POB 850, Rome, NY 13440.

CP/M.D., a utility program that diagnoses and cures ailments of CP/M disks. Menu-driven functions and a variety of commands recover files from bad disks, locate and lock out bad sectors, and translate decimal numbers to hexadecimal and binary codes. Floppy disk, \$29.95. Teleprint Inc., Simpl-Simon Software, POB 10, Sylvania, GA 30467.

Magic/L, a general-purpose interactive language. Applications include mailing-list, hardware diagnostics, debugging routines, an image-processing system, database query system, a turnkey process-control system, and a cross-assembler program. Floppy disk, \$295. Loki Engineering Inc., 55 Wheeler St., Cambridge, MA 02138.

Menu, a utility package that automatically sorts disk files using number codes without typing filenames. You select numbers and Menu handles functions such as copy, re-

name, erase, type, restore, compare, and more. You can secure sensitive disk files with password protection and explore the internal system while programming. Floppy disk, \$149. Computing, 2519 Greenwich St., San Francisco, CA 94123.

Real-Time C, a utility program that provides users of Whitesmiths' C compiler with an alternate run-time library suitable for real-time programming. The library consists of approximately 100 modules combined into two library files. Features include command-line parsing and error handling accessible to the application programmer. Floppy disk, \$95. Kadak Products Ltd., 206-1847 West Broadway Ave., Vancouver, British Columbia V6J 1Y5, Canada.

SAL/80, a utility compiler and language program. This program lets you maintain and reduce development and debugging time, and test branch code. It includes a complete set of console input/output primitives that perform case and base conversion, byte, word and string input/output through standard system calls and provide data manipulation using arithmetic functions. Floppy disk, \$59. Protocols, 24225 Summerhill Ave., Los Altos, CA 94022.

Text Addresser, a word-processing package that runs CP/M 2.2. A categorized address book automatically addresses letters. You can edit, move text, center text, and print. Floppy disk, \$39.95. Extal Alstar Inc. (see address above).

Commodore

Casual Writer, a word-processing program. You can write letters and lists, print

Software Received

popping popcorn. You're often treated to slapstick cartoons. For II, II Plus, and IIe; floppy disk, \$34.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Spell Perfect, a spelling-correction program that detects misspelled words. Reduce proofreading to a one-step process with easy prompts, a word count, a dictionary you create, and displays of words that are spelled similarly. For II, II Plus, and IIe; floppy disk, \$89.95. LJK Enterprises Inc., 7852 Big Bend Blvd., St. Louis, MO 63119.

Unit Professional, a library unit to be used with programming in Pascal. You can solve some of the simpler problems of formatting and error checking on input and output before you code it. Screens and their fields are

user-defined. For II Plus and IIe; floppy disk, \$39. D & L Professional Micro-computing, 1201 Lincoln Ave., New Castle, IN 47362.

Wizardry—Legacy of Lylgammyn, a three-dimensional fantasy and adventure game. This is the third scenario in the Wizardry series in which you are one of the descendants of the heroes of the Knight of Diamonds. As such, you are to seek the dragon L'kbreth and regain the mystical orb to balance nature's upheavals. For II, II Plus, IIe, and III; floppy disk, \$39.95. Sir-Tech Software Inc., 6 Main St., Ogdensburg, NY 13669.

Wordworx, two educational word games for all ages. Myspellery is a vocabulary builder in which you decode mystery words using as few clues as you can. Sentence

Maker challenges your ability to invent grammatically correct sentences given a string of five letters. You can add your own mysPELLeries to challenge other players. For II Plus and IIe; floppy disk, \$34.95. Reston Publishing Co., 11480 Sunset Hills Rd., Reston, VA 22090.

Atari

Capture The Flag, a two-player game for all ages. In a split-screen display, the invader must exit the three-dimensional labyrinth through one of two doors to reach the flag. If the defender touches you it will prevent you from capturing the flag. Adjusted tempo in music reflects action. For 800/1200; floppy disk, \$39.95. Sirius Software

Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Moviemaker, an interactive sequential-animation package in which you are a movie director. You devise the action, set the scene, and create actors, and the program plays back the completed computer-generated movie. For 800/1200; floppy disk, \$60. Reston Publishing Co., 11480 Sunset Hills Rd., Reston, VA 22090.

Nightraiders, a space-war game. You have joined the Nightraiders corps to rescue Earth from tyranny. Destroy the enemy's military strength and cross the battlefield to attack the base. As you fly over enemy territory you encounter targets such as a tank, bridge, radar tower, missile, train cars, and more. For 800/1200; floppy disk, \$29.95. Datamost Inc., 8943



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Fullbright Ave., Chatsworth,
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Popeye, an arcade-type game. As Popeye, you must catch all of Olive's hearts, notes, and cries for help before they hit the water and sink. Eat spinach for strength but beware of Brutus, the Sea Hag, and vultures. Levels of difficulty increase. For 400/800/1200; cartridge, \$40. Parker Brothers, 50 Dunham Rd., Beverly, MA 01915.

The Return of Heracles, a Greek mythology adventure game. When you become a Greek hero or heroine, Zeus will assign 12 tasks but will not offer any clues as to how to do them. The Oracle of Delphi has the advice you seek, but it's not free. For 800/1200; floppy disk, \$32.95. Quality Software, Suite 105, 6660 Reseda Blvd., Reseda, CA 91335.

CP/M

Co-Sort, a sort-and-merge utility program. With this program you can sort small data sets using a fast algorithm without transferring files. It allows for fixed- or variable-length records, all data types, and provides many keys in any direction. Floppy disk, \$200. Information Resources, Box W, Manhasset, NY 11030.

List-master, an information-management utility program for CP/M 2.2-based systems. You can keep track of lists including 30,000 data items, each with 252 characters. It includes a full-screen editor for data entry, sort and criteria-select procedures, and integrates with BASIC programs. Floppy disk, \$149.95. Palace Software, RD #1, Box 331, Moundsville, WV 26041.

Magikey, a keyboard-enhancement program for version 2.2-based systems. This program lets you define and assign a string of characters to any key. Features include built-in batch-processing capabilities, console and printer I/O redirection, and extensive string-editing options. Floppy disk, \$100. Pro Microsystems, 16609 Sage-wood Lane, Poway, CA 92064.

Plotpro, a set of three Micro-soft BASIC programs that make scientific applications graphs on any 80- or 132-column printer. Protemp creates templates of the physical appearance of any graph. Pro-quick controls plotting and printing of infinite-length graphs. Plotpro creates linear and logarithmic plots and can plot multiple functions on the same graph. Floppy disk, \$49.95. BV Engineering,

POB 3351, Riverside, CA 92519.

Commodore

Music Tutor, a set of six programs that teach beginning music students the basic elements of music. Programs include bass- and treble-clef notes, rhythms, symbols, music terms, and a review game. For the 64; cassette, \$30. MKI Software, 15295 Oceana, Allen Park, MI 48101.

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Photo 4: Using the manufacturer's blueprints, the Cray at Digital Productions simulated this Pontiac Fiero, which assembles itself from pieces that fly in from all directions. Mario Kamberg and Jim Rygiel were the creative and technical directors, respectively. (Digital Scene Simulation (sm) by Digital Productions, Los Angeles, CA. ©1983, all rights reserved.)

the term *computer imagery*. Reality is only a measure, not a goal."

Advice? "It's not easy to get into computer graphics, but I suspect it's going to get easier. People will be making pictures with computers from now on, and anyone who knows how will be in demand. Go to school and learn how to program; find out how graphics algorithms work."

Photos 2 and 3 are examples of Lucasfilm's work.

Patricia Cole (Atari)

The people at Atari's advanced graphics research and development division are interested in both games and motion-picture special effects and work at times with Lucasfilm. Pat Cole is in charge of the division and was previously with Lucasfilm, the Jet Propulsion Laboratory, and NASA.

The creation of the computer-generated visuals for *Superman III* in 1982 was one of her first jobs. "*Superman* needed the immediate visual impact of a video game, but with better than current game technology. We decided to do a two-and-one-half-dimension

computer animation. [Flat images with some spatial aspects are called 2½-D.] We built a software system for this on top of an existing system we use to develop our games, programming in LISP on a Symbolics LM2 under Paul Hughett's leadership. In the meantime we have also been establishing a full-blown three-dimension image synthesis animation facility—technology which is literally right around the corner for us. This is primarily oriented toward developing videodisc games, but we aren't drawing too many boundaries. As the facility grows and develops a personality of its own, we want to be able to do other types of projects."

Cole offered some advice. "The first decision a person has to make is whether they're more interested in the creation aspect or the technical aspect. This isn't necessarily an either/or situation, but the ideal is to have some people who are primarily creative and others who are primarily technical, knowing that talents overlap and merge. I don't encourage artists to go back to school and get a degree in math, but you should get as much experience, even working on

a home computer, and exposure—going to conferences and seminars, like SIGGRAPH—as you can. Become familiar with the jargon and with the capabilities and boundaries of the technology. Similarly, people with a technical background would benefit greatly from a basic course in design and from visiting art museums and getting an appreciation of the artistic world. The ideal goal is a common visual vocabulary, a common communication, so that this overlapping knowledge can increase."

John Whitney Jr. (Digital Productions)

The world's most powerful production computer, according to *The Guinness Book of World Records*, is the Cray XMP. The first of these magnificent beasts belongs to Digital Productions, a company founded by John Whitney Jr. and his associate Gary Demos. (Photo 4 was created by Digital Productions.)

Growing up immersed in state-of-the-art movie technology, Whitney did the first computer graphics for Hollywood movies, *WestWorld* and *FutureWorld*, at Information International Inc. (Triple-I), working with Demos. They coined the term Digital Scene Simulation*. In 1982, Whitney and Demos got the funding they needed to lease their first Cray 1/S. It had about one-third the power of the current model, but it was the most powerful machine available at the time. Soon after they opened shop, Lorimar Productions brought them their first job: to do about 40 minutes worth of simulation for *The Last Starfighter*.

"Getting the XMP is a major development. The combination of the new hardware and continued improvements in software will give Digital Productions a major thrust forward. Databases of 1 million polygons on the 1/S computer began to require an unacceptable amount of time per frame. We hope to compute scenes with the XMP on the order of 1 million polygons plus and still maintain a speed of 200 seconds per

*Digital Scene Simulation is a service mark (sm) of Digital Productions.

Simulation and Graphics on Microcomputers

Some graphic examples that may be worth a thousand words

by Ronald R. Miller

It is difficult to relate the output of a simulation model to the physical system it describes. Graphic representations of results can make simulations more credible and more interesting. On most large computers, however, there are software and hardware barriers between the user and graphical output. Microcomputers, on the other hand, are easy to use, and simple graphics are easy to produce without help from a programmer or systems specialist. Examples show bar charts, snapshots,

dot plots, bit density plots, and contour plots of simulation results generated using an Atari 800 microcomputer, a color television, and an Epson MX-80 printer (costing about \$600) with graphics capability. All the user must do to obtain such plots is write short programs (less than 100 statements) in BASIC.

Simulations Need Graphics

Vendors of graphics software have spent a lot of money advertising the benefits of graphics in displaying

computer output. Virtually every computer installation boasts of some graphics capability. Yet those of us who use computers and their output see very little graphics in practice. That is unfortunate because graphics is a tremendous aid in validating, verifying, and making credible simulation models.

Just how hard is it to determine whether a simulation model behaves properly? Consider the usual path (see figure 1) a model follows in going from concept to computer output.

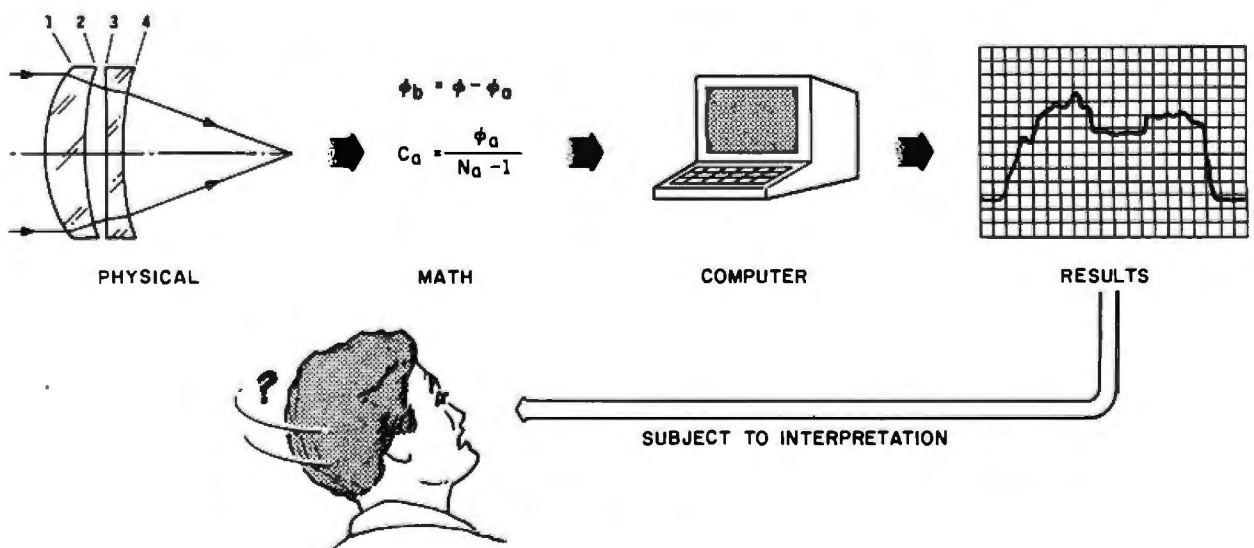


Figure 1: Distance between the simulation user and the underlying system. It is difficult to relate the result of a simulation to the physical system it describes.

Step 1 is usually the translation of the concept, say of a physical system, into a mathematical model. There are many pitfalls in this translation. It takes a mathematician of great skill to build a model of a physical system that adequately captures its essential features.

There are even more pitfalls in building computer models from mathematical models. The computer model requires a translation from traditional mathematics into numerical methods and discrete computations. Most simulation specialists are aware of the problems computers have with rounding and truncating numbers. Some are aware of the fact that computer solutions of perfectly good equations can go bad without any warning. Few simulation specialists realize, however, that a computer model of any complexity can never be fully tested. For example, each branching condition in a computer program creates two different execution paths. It is not uncommon for a small simulation program to have over 100 branching conditions. This represents a potential of two to the hundredth power or 1.27×10^{30} paths through the program. Even at today's computer speeds, one could never test every path.

Finally, there is the interpretation of model results. Each person usually has a different idea of what the results mean and whether they are valid in a particular situation. This problem is compounded by the fact that the mathematical modeler, the programmer, and the user are often different people, and each typically understands little of the others' areas of expertise. Under these conditions, believing the results of a simulation is like believing a rumor after 100 people have passed it on.

Graphics provides a window through which one can observe the behavior of a simulation. Everyone agrees that this is useful. Yet even with a lot of motivation and money, there is still not much graphics. Why? The answer is simple. Graphics is difficult to generate. The layers of hardware, software, and people between the computer and its users are a barrier that few can afford to penetrate.

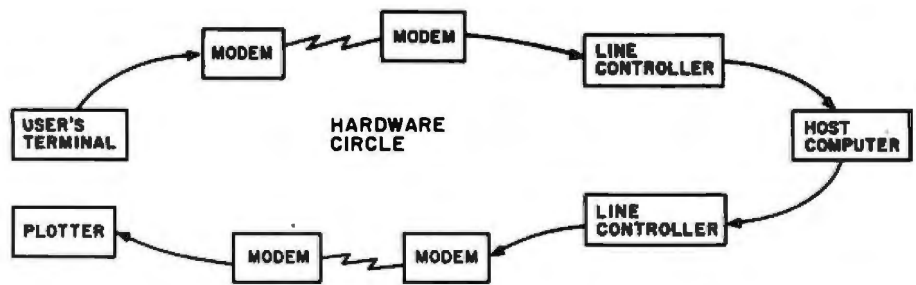


Figure 2: Layers of hardware between a computer user and a plotter. Many layers of hardware make systems inflexible and unreliable.



Figure 3: Layers of software between the user and graphical output. Lack of knowledge of software layers denies most users access to graphics.

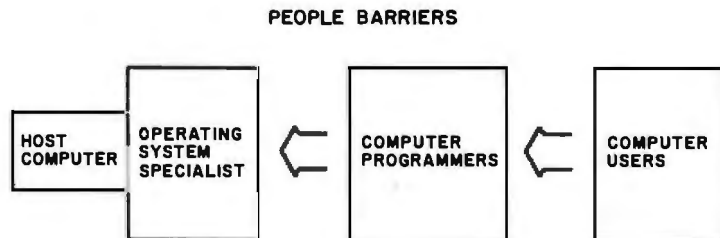


Figure 4: Layers of people between the user and the computer form a barrier. This barrier is difficult to penetrate.

Most users are not aware of how much hardware (see figure 2) there is between a computer terminal and the typical plotter. When problems occur, it is hard to determine if their source is hardware, software, or administrative (e.g., failure to activate a communications channel). When everything is working properly, the software forms the largest barrier to the computer user. For users to produce graphics on most systems, they must understand an installation's administrative procedures, operating system commands, editor commands, a programming language or the graphics vendor's software commands or both, and postprocessor commands that drive a particular graphics device (see figure 3). The 12-inch stack of documentation on the software layers forces most graphics customers to look for technical help.

The problem in finding technical help is that the user needs informa-

tion from two different groups of people (see figure 4). One group is the operating system specialists who implement an installation's administrative procedures, install software packages, and determine the source of system problems. The other group is the computer programmers who use these software packages as components in computer models. Assembling a team to implement graphics for a simulation is thus expensive. The cost and complexity limit graphics to projects that have the required time and budget.

Producing Graphics on Microcomputers is Easy

The best approach to penetrating the hardware, software, and people barriers is to eliminate them partially or completely. This is exactly what microcomputers do. The following characteristics of micros make them accessible:

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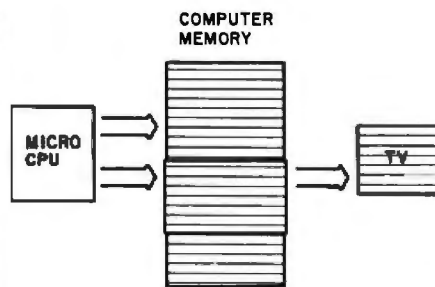


Figure 5: Microcomputer systems keep an image of the graphics screen in memory. In raster graphics the television displays a section of the computer's memory that the computer can change easily at high speed.

- Their operating systems do not require administrative procedures such as acquiring charge numbers, establishing user identification numbers, allocating disk space, or unlocking data security systems. Users just turn microcomputers on and use them.
- The operating systems are simple and easy to use. Thus the learning curve is short.
- All graphics hardware and software are integrated into one unit. This improves both reliability and reproducibility.
- Graphics is part of the built-in programming language (usually BASIC). Thus, the programmer can add graphics to his or her toolkit by simply learning a few extra statements or commands.
- Color graphics is usually built in. No additional translation process is required.
- The built-in character set is easy to change to a set that is relevant to the simulation. This allows the programmer to relate the graphics to the system being simulated.
- Built-in raster graphics makes pictures easy to change because the television picture is being redrawn many times per second. Changing a picture is fast and cheap. Animation is possible.
- The plotting capability of low-cost dot matrix printers allows one to readily obtain hard copies of the graphics screen. The user can have compact high resolution plots at the touch of a button.

The direct driving of displays (see figure 5) is what makes micros such powerful graphics machines. Direct

drive means part of the computer's memory is devoted to maintaining the display. There is a mapping of memory onto the video display. Dot matrix printers with graphics capability can also access this section of computer memory to produce a hard copy of the display. What you see on the display is what you see on the printer, dot for dot. The contents of memory can also be stored on disk or transmitted over telephone lines. This means pictures can be stored, transmitted, and retrieved just like any other data.

Micros Do Have Limitations

Micros cannot replace expensive graphics systems costing over \$20,000 because of limitations in speed, memory size, and display resolution. Typical microcomputers address between 64K bytes and 256K bytes of memory and have a maximum graphics resolution of 200 by 300 dots using one color. A typical minicomputer-based graphics system has more than two megabytes of memory and a graphics resolution of 1024 by 1024 dots using eight colors. Microcomputers have no graphics standards, and graphics is normally not transportable between micros, particularly ones from different manufacturers. Many small applications, however, do not need more capability than the micros provide and most applications require only an hour or two of programming time to produce pictures. Since the investment in programming time is small, users who switch computers are generally willing to rewrite graphics programs from scratch.

Users can learn about microcomputer graphics easily from hobby-level magazine articles and books. These articles and books give simple explanations and nice comparisons between graphics methods and systems. However, these sources do not help the user determine whether micros are suitable for a given application. The best approach is to employ common sense. Even if an application turns out to be unsuitable for microcomputers, the education gained will be valuable in software design for a larger system.

Some Very Graphic Examples

The following examples demonstrate the kinds of graphics that micros can produce. One obvious application for this capability is in education where small-scale problems are studied in detail. However, any simulation that fits on a micro

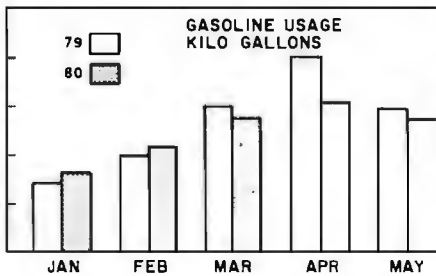


Figure 6: Bar chart representation of simulation output. Conventional bar charts can be generated easily on a video-display terminal and reproduced on a dot matrix printer.

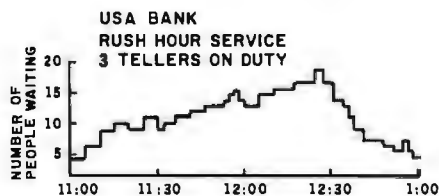


Figure 7: Time plot of the state of a queuing system. The fine resolution of the graphics screen allows compact summaries of the results of a simulation.

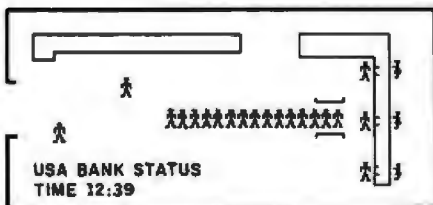


Figure 8: Graphical representation of the current state of a queuing system. The ability to redefine the computer's character set simplifies the graphic representation of objects involved in a simulation.

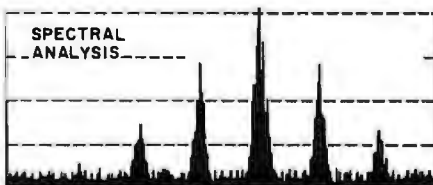


Figure 9: Dot plot representation of simulation output. The dot plot capability of dot matrix printers allows printing of simulated displays from test equipment such as a spectrum analyzer.

can use these graphic techniques.

Figure 6 shows a conventional bar chart. The resolution of this picture is 61 dots/in horizontally and 76 dots/in vertically. The maximum resolution of the printer is 120 dots/in horizontally and 216 dots/in vertically. It takes about 30 BASIC programming statements to produce this plot, representing about 30 minutes of programming effort.

Queuing problems are perfect targets for graphical output. It is much more informative to see queues evolve in time than to have only peak and average statistics as outputs. A good enhancement to the plot of

figure 7 would be to place the results of many simulation runs on the same graph. This plot was produced with about 30 BASIC statements representing about 30 minutes of programming time.

Figure 8 is a snapshot of the state of a small bank simulation. Snapshots provide information in a form that is easy to understand. Snapshots can even be changed 60 times per second to produce real-time output. The user could then watch customers arrive at the bank and be served. If the waiting line gets too long, the user can easily add another teller and rerun the simulation. This kind of

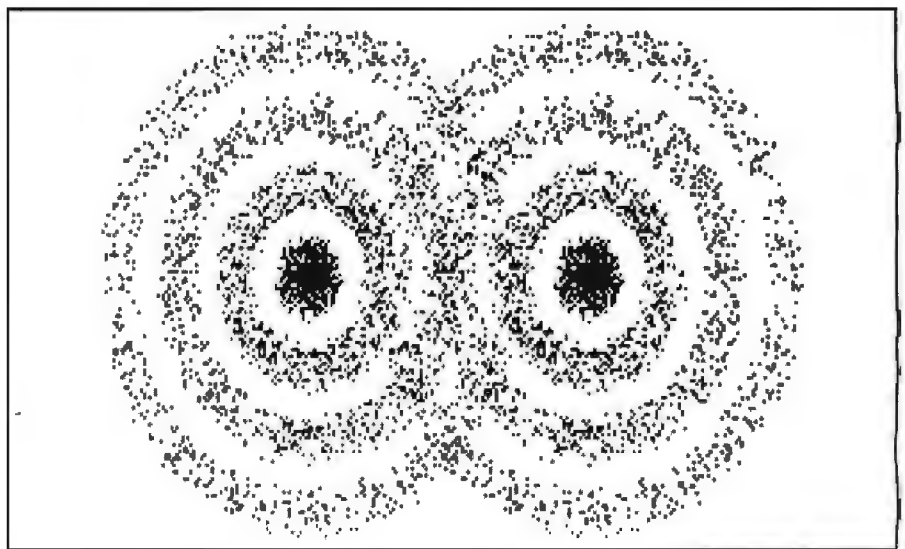


Figure 10: Bit density plot of wave propagation. Two-dimensional wave propagation can be displayed using bit density plots on a grid of over 60,000 discrete points.

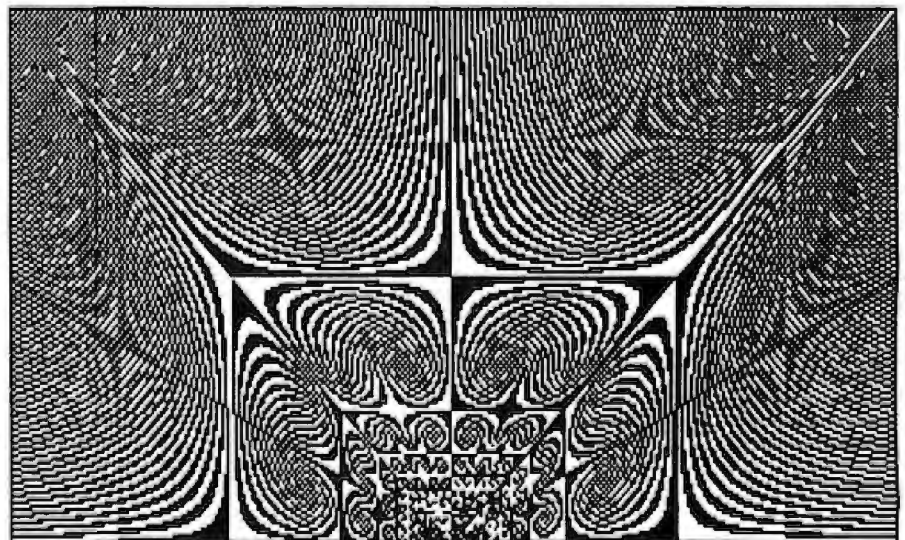


Figure 11: Contour plot using varied dot densities. Some computer output is not numerical and only has meaning when displayed graphically as in this moiré.

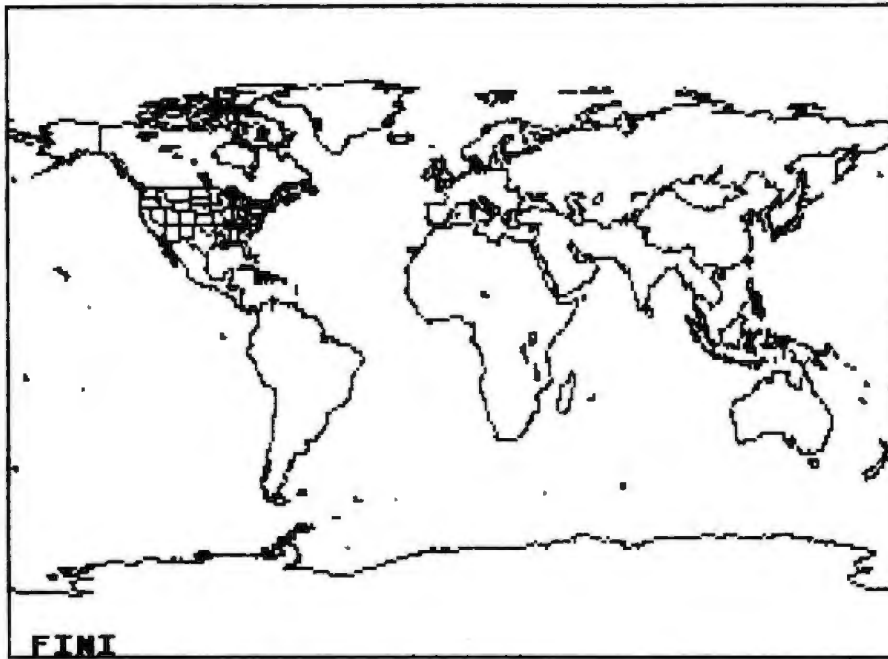


Figure 12: Cylindrical equatorial projection. Geographic maps make good backgrounds for plotting results of demographic, economic, political, or meteorological simulations.

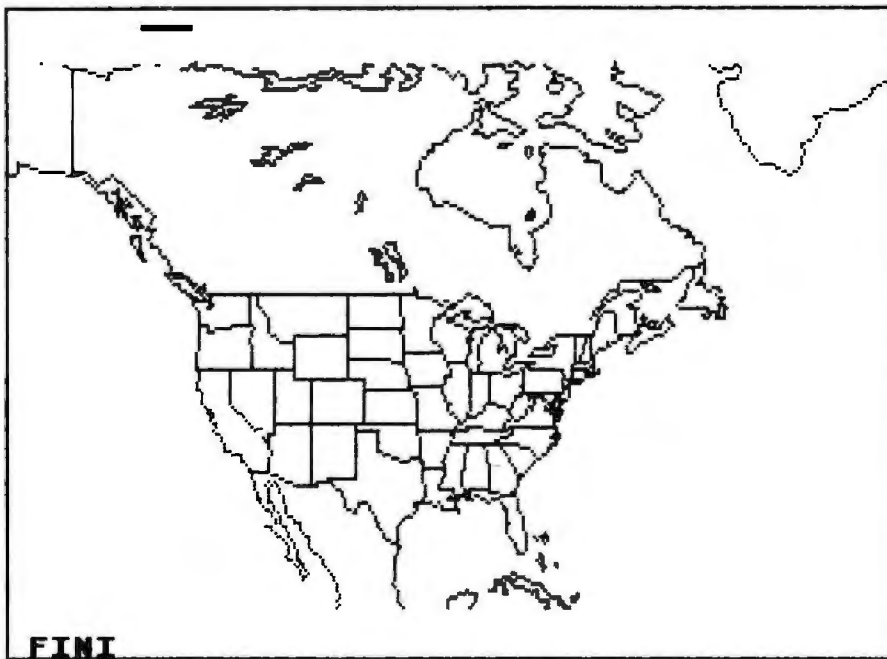


Figure 13: Cylindrical projection of North America. Geographic maps can be manipulated to produce the appropriate background for plotting simulation results.

simulation has high credibility since anyone can observe and understand the behavior of the model.

In the analysis or simulation of electronic circuits, we could present results in the form that test equipment displays would produce for real circuits. This makes it easy to compare theoretical and actual circuit performance. Figure 9 shows an example derived from a spectrum analyzer. Simulation of test equipment

displays is also useful in computer-aided instruction.

The resolution of raster displays is good enough to generate plots using dot densities to represent a third dimension. The entire plot in figure 10 was produced with the single statement `PLOT X,Y`. This plot is a good example of the fine resolution available on a \$600 dot matrix printer. This plot took 2 hours to generate and 45 seconds to print. One exciting idea is

to generate plots using red and blue dots and print them using color separation and color carbon paper. The plots would appear to be three-dimensional when viewed through red-green glasses.

The plot in figure 11 looks complex, but was generated by about 30 BASIC statements. It shows the effect on the eye of varying dot densities. In color, this plot is spectacular because of the blending that occurs when colors are plotted next to each other on a television. Even in black and white, one sometimes sees brown bands in the dot patterns. This kind of plot would be useful in producing contours or surface maps. It is another way to produce the illusion of three dimensions.

Figure 12 was produced with 100 BASIC statements that access a file of 8800 coordinates representing the surface of Earth. The program plotted this map in 12 minutes and printed it in 45 seconds. This program with data costs about \$21.

Figures 12 and 13 were produced by the same program. Figure 13 demonstrates zooming in on a selected part of Earth's surface. Once these maps are plotted, they can be saved on disk and used repeatedly. It takes about 60 seconds to save or retrieve a map from disk. ■

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Chalk Board's Powerpad and Leonardo's Library

A new large touch panel for the Atari 400/800, the Commodore 64, and the Apple II comes with a wide selection of software

by Elaine Holden

At last! Technology is finally beginning to incorporate educational philosophy. A new company, Chalk Board Inc., has come up with the Powerpad (hardware) and Leonardo's Library (software). The Powerpad, shown in photo 1, is a touch-sensitive pad that is used by the programs in Leonardo's Library as the primary input. The programs teach visual arts, music, mathematics, science, language arts, and social studies. However, only a fraction of the total series of educational packages is currently on the market.

The Powerpad does not involve traditional teaching approaches such as ditto sheets (those awful purple unreadables handed out by many teachers) and workbooks. Instead, there is direct interaction and immediate feedback with this teaching tool. This is referred to as the multimodal approach. In other words, if you touch it while you hear it and see it, you remember it longer.

Powerpad

The main component of the product is a 12-inch by 12-inch touch pad housed in a 20-inch by 17-inch hard plastic case. Mylar overlays that are part of the software package take the place of a conventional keyboard. Some areas of the pad are defined as keys, depending on the program. The flexi-

bility of the Powerpad expands the range of potential users. Because an intricate keyboard is not involved, children and nontyping adults can learn with the computer in a much more relaxed and natural fashion.

The Powerpad connects through the game input port of your computer. It is lightweight, well constructed, and very versatile. [Editor's Note: See the text box on page 270 for technical notes on the Powerpad.]

Leonardo's Library

The set of learning packages is named after Leonardo da Vinci, who explored many areas of study. Similarly, Chalk Board's library tries to cover many disciplines in

the Renaissance tradition. Each discipline has packages that range over five levels of sophistication and complexity. Almost any child or adult can locate a program at the appropriate educational level without becoming frustrated.

Included with each software package is a Mylar overlay sheet that fits over the active surface of the Powerpad. The overlay defines areas of the pad's surface that correspond with specific functions. The matching overlay imprinted with color-coded "buttons" serves as the menu and as special function keys.



Photo 1: The Powerpad with the Mylar overlay for Micromaestro.

For this review, I had access to three of the available packages from Leonardo's Library—Leo's 'Lectric Paintbrush, Micromaestro, and Powerpad Programming Kit. The first two packages help learners discover art and music; the third allows you to use the Powerpad as an input device in your own BASIC programs.

Leo's 'Lectric Paintbrush

Briefly, this program lets you finger-paint electronically. Using Leo's 'Lectric Paintbrush has to be the most fun I've had since I dipped my fingers into a paint dish as a six-year-old in Mrs. Sparrow's first-grade class.

Brush, paint, and crayons are often regarded as too messy for frequent use by children. Only when art class has begun or mother has the patience can a child paint. We tend to forget that a child's timetable may be different from ours, and later we are often disappointed when children do not develop enthusiasm for art.

With this program, you don't need paints or even paper. A stylus is provided, but I much preferred my fingers. The stylus, however, is useful for drawing fine lines. All you have to do is press the pad and the image appears on the screen.

The 36-page instruction booklet provided a very considerate walk-through of all the capabilities of the Paintbrush program, but it did not answer all my questions. It did, in fact, raise some of its own. These probing but

nonthreatening questions provide directions for the learner without stifling the process of discovery. I had to experiment and explore to answer the questions.

Eight colors are provided for the palette. With the colors and my fingers, I was ready to create a masterpiece. Naturally, at first, I left small green fingerprints all over the place while trying to pinpoint where I left off. There's no way to tell on the Powerpad where I had already painted. The images show up only on the screen. Then I discovered that, much like my Logo program, the Powerpad has a Pen-up command that lets me see where my finger is without marking on the screen. When my finger is in the right place, I press the Pen-down area to recommence drawing.

First, I attempted to draw a landscape. Traditionally, a bright yellow sun hovers over all my versions of Mt. Monadnock. I used the Fill command to color in my sun. This is when I discovered that an incomplete circle (or any other shape, for that matter) will leak color all over the landscape. Cancel stopped the process and I cleaned up.

You can also move objects. The manual suggested making clouds. They fit in the picture, so I did. To and End commands define objects. I defined a cloud and used the Move command to put a second cloud, just like the first, in another place. Failing to recall the Pen-up command, I first positioned the cloud in the treetops. Even-



Photo 2: A landscape created with Leo's 'Lectric Paintbrush.

tually it made its way across the sky to the right position, then I cleaned up all my little fluffy fingerprints. The result is shown in photo 2.

You can get quite carried away with this and before long discover that all the computer's memory is used up. Economical use of computer memory is learned through trial and error at this stage but, to make it less frustrating, a Hashmark key (#) is provided on the Mylar overlay as well. When pressed, this key provides a vertical gauge of memory to the right of the picture. The artist can determine how much memory is left because, as he draws, this gauge fills with color.

Pictures can be saved; very clear directions are provided for this, with sample experiments. The experiments stimulate a learner rather than just provide him with lockstep directions. Too many programs give such precise directions that the student behaves like a robot. This is not teaching, this is programming.

Complete referencing is the form of an index is also provided. This is very useful for beginners. It is clearly organized and not complicated.

Micromaestro

This program is an answer to a music teacher's prayer. Limited funds prohibit quantity purchases of pianos, so classes often only hear music, but never make it. Prior solutions have included recorders for all (an agony of sound) and cardboard keyboards (no sounds but everyone got to practice).

Structured music class, individual classroom practice, and home use are all possibilities for Micromaestro, shown in photo 1. Naturally, this program is not a substitute for the real McCoy. I have yet to be convinced that any electronic marvel will ever take the place of a real piano. But basic music theory and composition can effectively be learned through this program. Its visual display function is especially useful, because it lets you

At a Glance

Name

Powerpad, Leonardo's Library

Type

Hardware and accompanying Programming Kit;
Software: Micromaestro,
Leo's 'Lectric Paintbrush

Manufacturer

Chalk Board Inc.
3772 Pleasantdale Rd.
Atlanta, GA 30340
(800) 241-3989

Price

Powerpad, \$99.95
Micromaestro, \$24.95
Leo's 'Lectric Paintbrush, \$24.95
Powerpad Programming Kit, \$24.95
Other software in the Library will be available at prices ranging from \$24.95 to \$49.95

Format

Cartridge or disk

Documentation

36- to 40-page booklets plus self-explanatory keys on the Mylar overlays

Computer Needed

Commodore 64 and VIC-20, Atari, Apple, IBM PC

Audience

Preschool to adult

see what you are playing on your computer screen. Photo 3 shows you what I mean.

Very little music theory is directly provided in the 40-page user's guide. I assume that this is because it is the most basic of the proposed five music packages and

The Technical Side of Powerpad

The Powerpad contains an x,y matrix of 120 by 120 wires. The wires are connected to several 4051 eight-channel analog multiplexer/demultiplexers. The 4051s along one axis are connected to +5 volts. A 4024 seven-stage binary counter makes the 4051s transfer the +5 volts to its matrix wires, one wire at a time. When the user presses the Powerpad matrix, the wires under the point of pressure touch each other so that the potential from one axis is carried over to the wires of the other axis. When this happens, the scanning process stops and the SENSE line to the computer goes low. This alerts the computer that the Powerpad has been touched and the coordinates of the touched area may now be read. The coordinates are stored in two 4021 8-bit shift registers that, for programming purposes, are treated as one 16-bit register. The 16-bit register always contains the values present in the two 4024 binary counters. The x-axis coordinate is stored in the least significant 7 bits of the register, and the y-axis coordinate is stored in the next 7 bits. The most significant 2 bits of the register are always

01. These are discarded by the computer.

To read the coordinates, the computer pulses the CLOCK line to the Powerpad high 16 times. At each pulse, the shift register outputs one bit of its contents to the DATA line through a 4069 inverter. When all the data has been read, the computer pulses the CLEAR line to the Powerpad high. This tells the Powerpad to place the SENSE line low and continue scanning for a touch. Note that the binary counters are not set to zero. Instead, they retain their count and continue the scan from there.

The scanning begins from the point 0, 0. The y axis is scanned from 0 to 119 while x remains at zero; then x is incremented by one, and the y axis is scanned again.

By the way, the Powerpad uses the same I/O port on the Commodore 64 that the keyboard uses. This means that you cannot use the keyboard while the Powerpad is communicating with the computer, although Chalk Board Inc. says that it will tell you how to use both if you join the Padmasters Guild, the Powerpad users group.



Photo 3: A visual reproduction of music played with Micromaestro.

also because the truly capable music student will attain a lot on his own.

The program carries the student along by suggesting various notes to play. Nothing much beyond this is suggested for songs, the remainder of the booklet being taken up with instructions on the use of various keys, symbols, and game suggestions. Hopefully, the remaining four packages in this series will teach some theory.

Powerpad Programming Kit

This programming kit consists of a blank overlay and a book that explains how to program the Powerpad with BASIC. This is not for the very young or the recent convert to the Computer Age. I was delighted with the program. Middle-school students who are familiar with computers and BASIC are naturals for this kit. I feel that average inquisitive elementary-age youngsters would have a problem, though, unless they are first instructed in the fundamentals of programming.

Conclusions

Leonardo's Library and the Powerpad are fine examples of educational tools. They follow sound educational philosophy, they stress creativity and problem

solving, and they have the element of surprise. With these programs, students cannot rush through an exercise to get done, look at the back of the book for answers, or ask someone else—they must discover on their own.

The electronic wizardry of the Powerpad is impressive, and the rigid plastic housing keeps it quite safe. I would say it will last for a long time under normal use. The Mylar overlays also seem durable but, should accidents occur, they can be replaced for only \$6.

In order for the student not to feel alone with his discoveries, another feature is the Padmasters Guild and the Chalk Board newsletter. The Guild membership is free to anyone owning a Programming Kit and costs \$9.95 a year for everyone else. Included is a hot-line number for troubleshooting and publications on new programs for the Powerpad written by other programmers. The newsletter answers questions and publishes users' comments and ideas. These features, plus the excellent software, add up to a useful tool in education. ■

Elaine Holden (22 Elm Street, Peterborough, NH 03458) is the supervisor of reading and language arts at the Merrimack School District in New Hampshire.

Simulated Computer II

by Richard Grehan

Back in my college days, the only programming languages I had under my belt were BASIC and FORTRAN. I saw the computer as a mass of equipment so hopelessly complex that assembly-language programmers were like Nobel laureates. If you find yourself viewing the prospect of having to learn assembly language with the same pessimism that I felt back then, or if you just want to get a better idea of what goes on inside a computer, then Simulated Computer II deserves your attention.

Simulated Computer II from Carousel Software Inc. takes you on a fantastic voyage inside an imaginary computer. You can watch system registers being loaded, memory locations being modified, and even see and hear information flow from one location to another. Simulated I/O (input/output) devices allow you to load programs, execute them, and display their results. Also included are a programmable sound generator and a "turtle screen," a version of the line-drawing creature used with the popular Logo programming language.

Main Display

Nearly all of Simulated Computer II's action takes place on a single screen. It displays the four major components of the simulated computer (see photo 1). In the upper left is the *input device*, a stylized representation of a terminal complete with screen, keyboard, and a pair of tiny hands ready to begin typing. As you enter commands, the hands actually dip down to strike keys on the imaginary keyboard (a very nice touch that enhances the reality of the simulation; I give the designers an A+ for that one).

The upper-right portion of the display holds the computer's *output device*, where all program output and system error messages appear. This is a printer—obviously equipped with a tractor feed, since you can see the little holes in the paper—that makes a wonderful sputtering sound as its print mechanism operates.

The lower half of the screen displays the computer's *memory*, a whopping 24 memory locations arranged in a 4 by 6 matrix of boxes. The address of each box is easily identified by an attached tag, so there is no confusion about where things are coming from or going to. The last four locations have special functions with regard to sound and graphics, which I will describe in detail shortly.

The central processing unit sits in a sovereign position in the upper center of the screen. Six boxes inside

the central processor represent its registers. Two of them, the accumulator and the program counter, are directly accessible by user programs. The other four—the instruction register, fetch register, increment register, and execute register—are used by the processor for its internal operation. The contents of these registers are visible at all times. (This simulated computer is a base-10 machine; registers and memory locations can hold numbers in the range ± 999 . Having all operations performed in decimal numbers—rather than the expected binary or hexadecimal—is actually a good idea, since people trying to learn what goes on inside a computer have enough on their hands without having to worry about number base conversion.)

Connecting everything is the *system bus*, the real star of the show. Information traveling from one part of the computer to another is represented by a white, glowing electron that whizzes along the bus. This is the addicting part of the simulation. You find yourself entering and running programs just to watch the light show, and, best of all, you get to see exactly what's going on.

Simulated Computer II sports a pretty lean instruction set (see table 1). All mnemonics are three characters long, usually followed by a two-digit address. I believe that the designers were trying to find the balance between a product that was too simplistic and one that was too complex.

The two primary system commands are LOAD, which allows you to enter program and numeric data into memory; and RUN, which begins execution. Instructions may be loaded directly into memory in their mnemonic representation, but when RUN is executed, Simulated Computer's first action is to scan through all memory locations, translating all mnemonics to their operation code values so that all you see in the memory boxes are numbers. The subtle lesson being taught here, something that people familiar only with high-level languages are largely unaware of, is that data and instructions are indistinguishable until they reach the central processor.

Various versions of the RUN command let you execute programs at speeds from about 5 seconds per instruction up to a half-second per instruction or even single-step, which causes the system to wait for a keypress between each event.

Sound

Simulated Computer's sound capability is accessed by



Photo 1: The Simulated Computer's main display, showing (clockwise from upper left) the input device (a terminal), the central processing unit, the output device (a printer), and system memory.

storing a number into memory location 20. The number must be greater than 0 and less than 37 (less than 92 for the Commodore 64 version). These values seem to correspond to three octaves of an even-tempered scale starting one octave below middle C. However, I found it nearly impossible to determine the relationship of value stored to pitch produced since the generated sound is just a short beep. Even running the program at top speed, time between tones is nearly 6 seconds. Add to that the racket of the electrons racing from place to place as instructions are executed, and you can hang up the hope of generating even simple melodies.

Turtle Graphics

Memory locations 21, 22, and 23 control "a memory-mapped turtle." (For anyone not familiar with the turtle, it is the software incarnation of a small robot used to produce line graphics. You program the turtle to move along a path, and it leaves a "trail" on the screen as it carries out your commands.) Storing a number in location 21 tells the turtle which color to draw, location 22 determines the angle (in clockwise degrees) through which it will rotate before drawing, and location 23 selects the distance it will move. It is the act of storing a number in location 23 that actually sends the turtle on its way.

At a Glance

Name

Simulated Computer II

Type

Educational Simulation

Manufacturer

Carousel Software Inc.
877 Beacon St.
Boston, MA 02215
(617) 437-9419

Available From

Apex Resources Inc.
17 St. Mary's Court
Brookline, MA 02146
(617) 566-1569

Price

\$29.95 suggested retail

Format

Cassette or disk

Language

Compiled FORTH (a FORTH interpreter is not required)

Computer

Atari series of microcomputers with 32K bytes of RAM or Commodore 64

Documentation

Approximately 35 pages

Audience

Anyone interested in learning the fundamentals of assembly-language programming (age range recommended by manufacturer: 12 to adult)

M.U.L.E.

Beneath its clever packaging lies a fascinating economic simulation

by Gene Smarte

Whoa, mule, whoa!
Whoa, mule, I say!
I ain't got time to kiss you now,
The mule has run away.

—"Buckin' Mule," traditional folk song

The fun-to-use economic strategy game M.U.L.E. (multiple-use labor element) lets you plot the economic development of a new territory on a planet called Irata. With your grubstake of money and goods and your knowledge of capitalism, you and three other "planeteers" are ferried to an undeveloped area of the planet. Once there, using the limited supplies of the general store, the planet's only structure, you must decide how to make the best use of your resources. Your supply ship won't be back for at least six months.

Before the game begins, the program introduction takes you through a demonstration in which you (and the computer, when there are fewer than four players) select a color and the type of creature—there are eight kinds—you wish to be. A brief description of each and its advantages and disadvantages is included. The computer always picks the mechanical Mechtron—but so can you. You also select the game level: beginner, standard, or tournament.

As the game begins, you have just landed on Irata and are watching your only link with help, your supply ship, cruise off into space. A status report lists the resources of each planeteer and the general store. (In the tournament-level game, the planeteers have but one round to become self-sufficient because their supplies are good for only one month.)



Photo 1: After you've chosen the level of difficulty, picked the number of planeteers, and decided which of eight characters you'd like to be, the disk leaves the demo mode and loads the game. You'll see your spaceship pass over Irata, descend and deposit you and your fellow planeteers, and disappear from view.



Photo 2: Inside the general store. After selecting a plot of land, you pay your money, outfit a M.U.L.E. for your selected task, and head out to install the critter. The empty colored rectangles become additional choices as the difficulty of the game increases. The vertical bar at the right edge is a shrinking time indicator; when it's gone, your time is up.

While "mule" might conjure up images of bearded prospectors and four-legged flop-eared beasts of burden, this M.U.L.E. is actually an intelligent (though sometimes unpredictable—it can run away) machine designed to resemble a real mule. You purchase it at the general store. Each M.U.L.E. must be outfitted for the task you choose: farming, energy production, or mining. Those are the main tasks of this game.

As in real societies, or "life in the rest of the galaxy," as mentioned in the player's guide, a balance must be struck between various needs and wants. In the case of Irata, you must have food, so farming is a requirement; you must have energy for the creation of all products, so energy production is necessary; and you must mine Smithore, the stuff from which a M.U.L.E. is made (except at the beginner's level), to ensure availability of the M.U.L.E. as the scope of Irata's development increases.

After the resource status report, the display shows an aerial view of the area of Irata to be developed. The landscape includes a fertile river valley ideal for farming, prairies for open-space energy production, and mountains for mining. A cursor scans the territory, and each planeteer chooses a plot of land by pressing a joystick push button. The color-coded plots correspond to the colors the planeteers select earlier in the game.

After the first round of plot selection, each planeteer has a limited time to enter the general store, decide which type of production best suits the plot just selected, outfit a M.U.L.E. accordingly, lead, via the joystick, the M.U.L.E. out to the plot, and install him (a M.U.L.E. is referred to in the masculine). Should you have some time left over, you can return to the pub in the general store and do a little gambling or go Wampus hunting. Gambling is an automatic way to win, but it ends your

turn. The Wampus, as explained in the *Player's Guide*, lives in mountain caves, and when he opens his door a light flashes that signals his whereabouts. You must move quickly if you expect to capture him. He's difficult to catch, but he'll pay you to let him go.

When each planeteer has installed a M.U.L.E., production begins automatically. But, just as in real life, random events can help or (more likely) hinder your production. Planetquakes, meteor showers, and an imaginative array of pest attacks can wipe out a turn's production. These random events are particularly clever in concept and execution and had me looking forward to the next one.

After production, planeteer and store resources are displayed and an auction for each commodity begins. Here, a dog-eat-dog capitalist mentality can help. But you must remember that if, for example, all the planeteers try to corner the Smithore market and no one does any farming, you all have a good chance of perishing on Irata (shudder). I liked this touch of realism.

If you have the cash, you can buy what you want, and you can sell any surpluses, providing someone is interested. Both buying and selling prices are set by the planeteers with some limits in the beginner's level. The program sets the store's rate of exchange. With the conclusion of the auctions, an updated status report prepares you for the next round of plot selections as your first month of development ends. The game continues for 6 turns (beginner) or 12 turns (standard and tournament levels). At the conclusion, the player who has accumulated the highest net worth is the winner.

It's impossible to adequately describe all the interaction and economically realistic subtleties of M.U.L.E. The standard level increases the complexity of the beginner level with land auctions and selling, development-

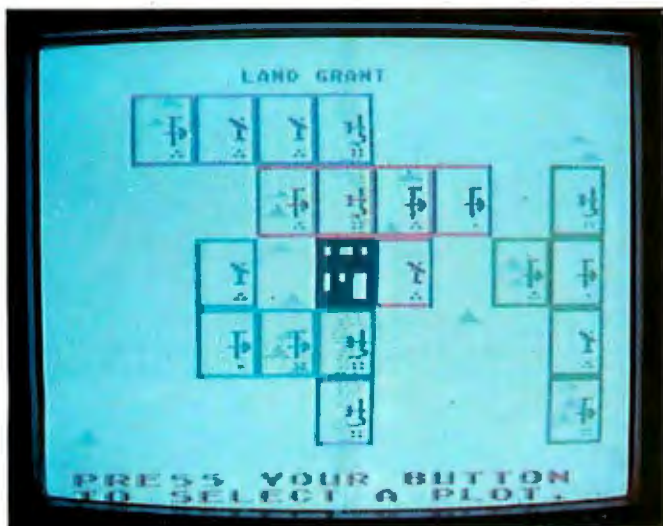


Photo 3: After five rounds, Irata real estate is getting scarce. Colored squares identify players' plots. Symbols within each square indicate that a M.U.L.E. has been installed. The best food production is in the central river valley; energy gathering is best in the plains; the mountains are loaded with Smithore.



Photo 4: One of the three auctions that concludes each round. In this case, the seller has come down to \$32 per unit; the buyers, however, are unimpressed as they are holding fast below the rock-bottom bid of \$15.

At a Glance

Name

M.U.L.E.

Type

Economic strategy game

Manufacturer

Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
(415) 571-7171

Price

\$40

Authors

Dan Buntin, Alan Watson, Jim Rushing, and Bill Buntin

Format

One 5¼-inch floppy disk

Language

Assembly language

Computers

Atari 400, 800 with 48K-byte RAM, Commodore 64

Documentation

6-page disk jacket, 20-page M.U.L.E. Player's Guide

Audience

Capitalists, entrepreneurs, and pioneers

strategy nuances, and gyrating resource prices. You can also sell below a "critical level" if you think that you can make it up later. The tournament level adds Crystite mining and Collusion (private trading between friends). Tournament play requires some fast thinking and razor-sharp business savvy because the time allowed for decisions is significantly shorter.

M.U.L.E.'s packaging and documentation make entertaining reading. In addition to providing an interesting description of the game's flow, the authors unveil their personal strategies. And the 20-page *M.U.L.E. Player's Guide* is peppered with playing tips along with the economic realities of pricing, economies of scale, the learning-curve theory of production, and the law of diminishing returns. This is definitely not a simplistic, learn it/be bored with it, kill-the-galactic-villains time-waster.

Conclusion

M.U.L.E. is an intriguing way to illustrate some of the triumphs and perils of free enterprise. While it falls in the broad category of games, it also offers an excellent means to test your business mettle. It's realistic, too, because just when you think you've done everything right, an unforeseen disaster can happen, like having your M.U.L.E. run away. ■

Gene Smarte is a BYTE technical editor. He can be reached at POB 372, Hancock, NH 03449.

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ministrators to create a test bank of up to 10,000 questions; add, edit, or replace questions; print copies of exams; and choose from a dozen other tasks. For II, II Plus, and IIe; floppy disk, \$49.95. Sterling Swift Publishing Co., 7901 South IH-35, Austin, TX 78744.

Termexec, a comprehensive communications package. You can log in via modem to a remote host computer, electronic bulletin-board system, or an information, news, or stock-market service. Features include expanded character set, long-file handling, scrolling, macro commands, exec files, full-screen editor, and more. A hotline is available for technical support. For II Plus and IIe; floppy disk, \$79.95. Exec Software Inc., 201 Waltham St., Lexington, MA 02173.

Atari

Cosmic Tunnels, an arcade-type game. Save your planet Sirref from energy starvation the Jebbs have imposed by destroying their space mines and missile launchers. Then retrieve as many glowing energy bars from four asteroids as you can while avoiding dynobots and quicksand. For 800 and 1200; floppy disk, \$34.95. Datamost Inc., 8943 Fullbright Ave., Chatsworth, CA 91311-2750.

FDOS, a disk operating system for FORTH users. In addition to performing normal DOS 2.0S file manipulations, this program also converts DOS files to FDOS files that are saved on your FORTH disk. You can create data files with existing BASIC programs operating under DOS 2.0S, and then convert them for use in a FORTH program. For 400/800 and 1200; floppy

disk, \$39.95. Superware, 2028 Kingshouse Rd., Silver Spring, MD 20904.

Hellcat Ace, a flying-combat simulation. The three-dimensional scene is in the Pacific during WWII. You confront 14 scenes in time ranging from 1940 to defending the fleet from Kamikaze attacks during the invasion of Iwo Jima in March 1945. Become an ace by maneuvering your aircraft through aileron rolls, loops, split Ss, and Immelmann turns. For 400/800; floppy disk, \$29.95. Microprose Software, 10616 Beaver Dam Rd., Hunt Valley, MD 21030.

Major League Hockey, a hockey-simulation game. Use your maneuvering ability to score goals and beat the other team. Features include a scrolling display of the rink and a game timer. Because the ice rink is triple the screen size, your view of the rink changes according to where the puck is. For 400/800 and 1200; cartridge, \$44.95. Thorn Emi Home Video, 1370 Avenue of the Americas, New York, NY 10019.

Monster Smash, an arcade-type game. You are the master of the local graveyard. The monsters who have moved in have destroyed the peace and quiet and are trying to escape through the gates. You must smash as many monsters as possible but let all the visitors and children pass through the gates unharmed. For 400/800 and 1200; floppy disk, \$29.95. Datamost Inc. (see address above).

Mountain King, an arcade-type game. Armed only with a flashlight and a thirst for adventure, you delve into the heart of a secret mountain and try to capture the crown. Carry it safely to the top of

the mountain before your time expires and you will become Mountain King; if not, you will be destroyed. Requires a joystick. For 400/800; cartridge, \$25. CBS Software, 1 Fawcett Place, Greenwich, CT 06836.

Party Mix, a collection of five arcade-type games. In *Bop a Buggy*, you drive a two-wheeled buggy through various screens to cross the finish line. In *Tug of War*, your team tries to pull the opposing team across the line. In *Wizard's Keep*, you control a wizard who releases his fireball to hit chickens or ships. In *Down on the Line*, workers must move packages around on colorful conveyor belts. In *Handcar*, you race on railroad tracks across the desert. For the 2600; cartridge, \$9.95. Epyx/Automated Simulations, 1043 Kiel Court, Sunnyvale, CA 94089.

Pooyan, a high-resolution arcade-type game. Battle a pack of vicious wolves to protect your helpless piglets. You shoot arrows at wolves that float in the air by holding onto balloons. For 400/800 and 1200; floppy disk, \$29.95. Datasoft, 9421 Winnetka Ave., Chatsworth, CA 91311.

Scroll It, a machine-language program. You can implement variable-speed fine scrolling in a BASIC program. The fine scrolling can be continuous horizontal, vertical, or diagonal; the ANTIC character mode can be changed; and the screen can be coarse scrolled to any x,y location. For 400/800; floppy disk, \$19.95. Superware (see address above).

Solar Fox, an arcade-type space-adventure game for one or two players. As Earth runs out of energy, you must navigate your starship through a complex matrix of

solar cells guarded by fireball-shooting Sentinels. The faster your speed, the greater your reward. See if you can unlock the secret of the Solar Fox. For the 2600; cartridge, \$25. CBS Electronics, 41 Madison Ave., New York, NY 10010.

Space Knights, a group of simulated science-fiction adventure games. As you follow Jake and Lisa through challenging encounters, you try to land your rocket on the surface of an alien planet or race through the Corridor of Time. Learn vector-trigonometry fundamentals in *Navigate*. For 400/800; floppy disk and book, \$24.95. Reston Publishing Co. Inc., 11480 Sunset Hills Rd., Reston, VA 22090.

CP/M

Datacure, an error-detecting and backup/restore utility program for CP/M version 2.2 operating systems. Using proprietary error-detection and correction techniques, you can reconstruct the original contents of disk sectors that have gone bad. Rebuild the original file and regenerate all the information for a complete track or for sectors damaged by a multitrack scratch. Floppy disk, \$99. Colorado Online Systems Inc., 40 Balfour Lane, Ramsey, NJ 07446.

FORTAN Relabel, a label-renumbering program. All the numeric labels in FORTAN programs containing statements and all labeled line references can be renumbered using this program. Subroutines, function subprograms, and Microsoft EDIT80 line numbers are processed automatically. You specify ASCII code and the numeric value of desired

What's New?

ten communications, Propel offers word processing, electronic mail, and meeting and reading notebooks. A spreadsheet and graphics constitute its number-processing abilities. In addition, Propel enables the Professional 350 to emulate DEC and IBM terminals for communicating with main-frame computers.

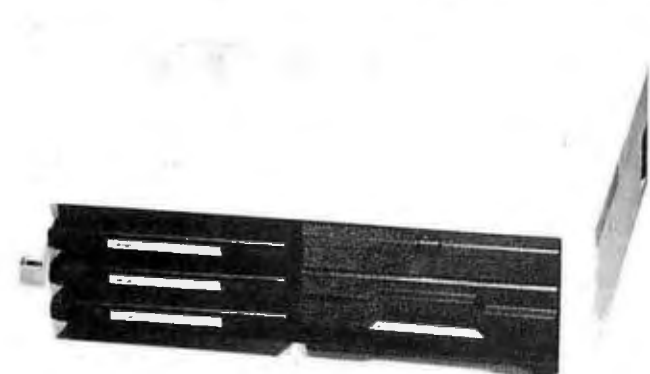
Propel can operate at four different levels of sophistication. Each level offers additional features for customizing applications. The software uses dedicated function keys, simple

menu hierarchies, single-key-stroke commands, and a consistent set of commands across all applications. Data transfers between applications are said to be simple. On-screen prompts for each menu option and help screens assist users.

Propel is available with or without the telephone functions for \$1195 or \$950, respectively. A toll-free hot-line number supports users. For full details, write to Pro Computing Inc., Suite 3314, One Penn Plaza, New York, NY 10119.

Circle 509 on inquiry card.

MASS STORAGE



Fluid Dynamics Boosts Storage Capacities

Omega's engineers have adapted eighteenth-century Swiss mathematician Daniel Bernoulli's principle of fluid dynamics to flexible-disk subsystems. Called the Bernoulli Box, the unit controls the movement of air around a flexible disk as it spins under the recording head. As the disk is enveloped by air, it rises to within 10 microinches of the head, creating a soft interface that permits high media density and rapid access. The average access speed is 30 milliseconds, and the transfer rate is 1 megabyte per second. The removable flexible-disk cartridge can handle 10 megabytes of formatted data. Cabinet dimensions are 5½ by

19½ by 18 ⅞ inches.

The Bernoulli Box is available in 10- and 20-megabyte versions for the IBM PC XT and the Texas Instruments Professional Computer. The 10-megabyte unit, which is upgradable to 20 megabytes, has a \$2695 suggested retail price. The 20-megabyte unit lists for \$3695. The 10-megabyte upgrade kit is \$1000. The disk cartridges cost approximately \$60. Omega also produces 5¼- and 8-inch cartridge drives capable of holding 5.2 megabytes of data. For complete details, contact Omega Corp., 4646 South 1500 W, Ogden, UT 84403, (801) 399-2171.

Circle 514 on inquiry card.

5¼- and 3½-inch Winchester Unveiled

Microcomputer Memories has unveiled a line of Winchester-disk drives aimed at the OEM and systems integrators market. The drives have ST-506 interfaces and offer 6.38 and 12.75 megabytes of storage and are available in half-height 5¼- and 3½-inch formats. These devices are engineered with such safety features as head-landing zones for recorded-data protection. The 12-megabyte unit features two oxide platters and manganese/zinc read/write heads, permitting less critical densities and enhancing reliability.

The single-unit price of the 12-megabyte Winchester drive in a 5¼-inch enclosure is \$1300. OEM pricing can be less than \$700. Address inquiries to Microcomputer Memories Inc., 7444 Valjean Ave., Van Nuys, CA 91406, (213) 782-2222.

Circle 512 on inquiry card.

Microfloppies Designed for Atari

A pair of 3-inch microfloppy-disk drives, the single-drive AMDC-I and the dual-drive AMDC-II, are compatible with Atari 400/800 and XL Series computers. Both units have an integral intelligent controller and DOS/XL operating system software. They can control up to four drives, each programmable for single- or double-density operation, and can be used in conjunction with 5¼-inch drives to boot Atari software. The media are Amdek's 3-inch cartridges, which feature an automatic shutter mechanism to protect against dust and fingerprints.

The AMDC-I provides 180K bytes of formatted storage. The AMDC-II gives you 180K bytes of double-density storage per side for a total of 360K bytes.

(Note that you must manually flip the cartridge.) The suggested retail price is \$599 for the former and \$850 for the latter. The 3-inch cartridge media are \$6.99 each. For full information, contact Amdek Corp., 2201 Lively Blvd., Elk Grove Village, IL 60007, (312) 364-1180.

Circle 511 on inquiry card.

Turbo-Disk Unveiled

The Turbo-Disk from New World Computer Company is a 5¼-inch Winchester-disk drive with a dozen read/write heads on each side of the disk. Its head slider assembly is mounted on a parallelogram that moves the read/write heads across a rotating disk in a purported 1/12th the time and distance of a single head. The Turbo-Disk provides an 8-millisecond access time for data under the heads and a 16-millisecond average access for remaining data. When not in use, the heads are locked above the disk surface, protecting data.

Turbo-Disk comes in configurations for the OEM and high-performance end-user markets. The first OEM model is a half-height 5-megabyte fixed-disk drive priced at \$1800. A 5-megabyte half-height fixed-disk drive enhanced with 5 megabytes of removable storage is available for \$2325. For end-users, the Turbo-Disk can be purchased as a 20-megabyte subsystem. This system features 5 megabytes fixed and 5 megabytes removable storage, plus 10 megabytes of additional storage in the form of two removable cartridges. It's provided with a power supply, disk controller, connecting cables, utility software, and a host interface that's compatible with IBM, Apple, DEC, S-100 bus, and Multibus systems. It lists for \$4950, with

TeloSchool, an administrative program for elementary schools. Keep track of almost 50 data items on each student, most of which you design. Eliminate repetitive typing by using standardized and customized reports and mailing labels. It also prints rosters and student profiles and tracks health problems, test scores, and participation in extracurricular activities. For II Plus and IIe; floppy disk, \$549. Telos Software Products, 3420 Ocean Park Blvd., Santa Monica, CA 90405.

Three Mile Island, a nuclear power plant management simulation. You manage a reactor with the touch of a few keys controlling valves, pumps, filters, and turbines. Stay within the budget, repair equipment, update your schedule, and prevent radiation leaks, interruption of electricity production, and the ultimate meltdown. For II Plus and IIe; floppy disk, \$39.95. Muse Software (see address above).

Tournament Golf, a golf-simulation program. Play golf from amateur to professional levels on two 18-hole courses. Graphics include fairways, greens, traps, and on-screen scoring. You practice on a driving range and putting green. But use strategy to avoid wind factors, woods, roughs, and water hazards. Up to four players can choose from 14 clubs displayed on the screen. For II, II Plus, and IIe; floppy disk, \$30. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Work Force II, a business program for home or office. Features include checkbook balancing, a printing calculator, loan amortization, savings rates, wage analysis, and a correctable typewriter. Menu provides for updating

data, change options, rerun programs, and printing of hard copies. For II, II Plus, and IIe; floppy disk, \$29.95. Core Concepts, POB 24157, Tempe, AZ 85282.

Atari

Cohen's Towers, an arcade-type game. You have been hired by your uncle to deliver the mail in his corporation. Avoid the boss's dog and the Corporate Spy who steals mail. Kiss the secretary for points and rise through the levels with as few demerits as you can. Requires a joystick. For the 400/800; floppy disk, \$29.95. Datamost Inc., 8943 Fullbright Ave., Chatsworth, CA 91311-2750.

Eagles, an air-combat simulation (see description under Apple). For 400/800 and 1200; floppy disk, \$34.95. Strategic Simulations Inc., Building A-200, 883 Stierlin Rd., Mountain View, CA 94043-1983.

Easy, a machine-language programming teaching tool using BASIC-like statements. This program, for use with AMAC or MAC/65 macroassemblers, can be used by both beginner and advanced programmers. Features include interaction with hardware by providing operations such as player-missile graphics, input/output, and scrolling. For 400/800 and 1200; floppy disk, \$39.95. Superware, 2028 Kingshouse Rd., Silver Spring, MD 20904.

Fortress, a medieval strategy game (see description under Apple). For 400/800 and 1200; floppy disk, \$34.95. Strategic Simulations Inc. (see address above).

Mr. Robot and His Robot Factory, an arcade-type

game. As Mr. Robot, you must collect all the power pills on one level before you can move on to one of the next 22 levels. Beware of obstacles such as moving treadmills, alien fire, energizers, and trampolines. Although you're given five lives, you get more if you can touch a life token. For the 400/800; floppy disk, \$34.95. Datamost Inc. (see address above).

Panzer Jagd, two tactical-combat games. You are a World War II commander of almost 20 German tanks with limited fuel supply that must cross a terrain full of randomly generated ambush points. In Panzerun, you command 25 armored and infantry units in battle under similar conditions. For 400/800 and 1200; floppy disk, \$30. The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Smooth Writer, a word-processing package. Four programs provide extensive editing, the abilities to break up files too large for processing, format and print short or long text, and a horizontal scrolling feature that lets you access and select documentation before printing. For 400/800 and 1200; floppy disk, \$79. Digital Deli, 3258 Forest Gale Dr., Forest Grove, OR 97116.

The Tail of Beta Lyrae, a high-resolution graphics game. Aliens have taken over your mining settlements. You must destroy their installations by traveling over a variety of terrains including mountains, natural and man-made caverns, and cities. For 400/800; floppy disk, \$34.95. Datamost Inc. (see address above).

Ultima I, an adventure game. You have over 30,000 game days to travel through

a mystical world consisting of monsters, oceans, grasslands, forests, mountains, towns, castles, landmarks, dungeons, and outer space. In the process, you must eliminate the evil Mondain who rules the world. For 400/800 and 1200; floppy disk, \$39.95. Sierra On-Line Inc., Sierra On-Line Building, Coarsegold, CA 93614.

CP/M

ADS (Asset Depreciation System), a utility package for CP/M 2.2 operating systems designed to fulfill the requirement of tracking the cost of asset acquisition and subsequent depreciation, including straight line, declining balance, sum of the year's digits, and double-declining balance. It also prints reports and stores the entire depreciation schedule for any given schedule. Floppy disks, \$64.95. Interactive Data Systems, 1409 B St., POB 2352, Marysville, CA 95901.

Dataplotter, a plotting package that prints publication-quality line graphs and scatterplots on dot-matrix printers. Features include a variety of symbols to represent points on graphs, an interactive program, and three utility programs that manipulate data files. Does not require a graphics terminal or programming experience. Floppy disk, \$50. Lark Software, 7 Cedars Rd., Caldwell, NJ 07006.

Index, a utility package for CP/M 2.2 operating systems designed to index documents and document packages, briefs, reference material, and letters used in daily business transactions. This package is also capable of indexing a document either in keyword or key-phrase order

A Computer in the Doctor's Waiting Room

An Atari program that offers some of the capabilities of an "expert system" for one physician's patients

George Zucconi, M.D.
Private Practice

For the past year I've kept an inexpensive computer in my office waiting room for my patients to use. The computer, an Atari 400, runs programs that impart medical information to the user. Instructions appear on the screen so that anyone can use the system without any aid from the office staff. The three programs I have developed answer the medical questions most frequently asked by the patients in my obstetrical-gynecological practice.

One program elicits information concerning symptoms of abnormal uterine bleeding. According to the user responses, it will diagnose the seriousness of the condition and will recommend what course of action the patient should take.

The other two programs are somewhat different in nature. One contains information about birth control methods, including the effectiveness, advantages, disadvantages, and risks of each. The remaining program, *Drugs in Pregnancy*, presented in this article, outlines 15 classifications of commonly available drugs and their effects on the various stages of pregnancy.

Though not meant as a substitute for doctor-patient interaction, the pa-

tients' use of these programs saves time for more complicated questions by eliminating basic preliminary queries. My patients take readily to the computer and have found the programs to be helpful. For one thing, using the computer avoids any feelings of embarrassment when inquiring about intimate matters. Furthermore, the computer is tireless and never scoffs at seemingly dumb questions. Even computerphobes overcome their hesitancy after watching someone else use the machine. In fact, it's unusual to see the computer sitting idly when anyone is in the waiting room.

The Genie in the Lamp

The educational use of computers promises to open up the possibilities for conveying information to others. With the proliferation of small, inexpensive computers, many more people will be able to afford these instruments and experiment with devising new applications for them. No longer the exclusive tool of the few, the power of the computer has been released like the genie from the lamp, waiting to grant us whatever wishes we command. In order to effectively develop the powers of the

microcomputer "genie," a concerted effort and sharing of knowledge are necessary.

The beauty of putting so many people in touch with computers is that by merely increasing the number of users, we will attain a "critical mass" wherein a breakthrough in learning is inevitable. Each new kernel of knowledge leads to another, building on the impetus of the previous one, all multiplying exponentially and cascading in a chain reaction.

This concept has long been the tradition in the medical profession. Scientific progress would be nonexistent without the dissemination of discoveries and information. Following in this tradition, I would like to share some efforts I have made toward devising medical applications for this versatile tool. I've provided the BASIC listing of the *Drugs in Pregnancy* program so that interested readers can use it or learn from its construction (see listing 1).

When the Doctor's Not In

You may not be anxious to expose a valuable computer to inexperienced hands or to children's sticky fingers. However, even if you do not give

Text continued on page 116

Listing 1: The source code for Drugs in Pregnancy, a program written in Atari BASIC that explains the effects of various types of commonly available drugs on pregnancy.

```

1000 REM INTRODUCTION
1010 CLR :DIM K$(1)
1020 GRAPHICS 2+16:POKE 77,0
1025 SETCOLOR 2,4,0:SETCOLOR 4,7,0
1030 ? #6: ? #6;" please feel free"
1040 ? #6: ? #6;" to come over"
1050 ? #6: ? #6;" and see what"
1060 ? #6: ? #6;" this computer"
1070 ? #6: ? #6;" can do"
1080 FOR J=1 TO 1000:IF PEEK(53279)=6 THEN 3000
1090 NEXT J
1100 GRAPHICS 2
1105 SETCOLOR 4,7,0:SETCOLOR 2,3,2
1110 ? #6;" YOU CAN ASK"
1120 ? #6: ? #6;" THE COMPUTER"
1130 ? #6: ? #6;" ABOUT THE"
1140 ? #6: ? #6;" EFFECTS OF DRUGS"
1145 ? #6: ? #6;" IN PREGNANCY"
1150 PRINT " PRESS YELLOW <START> PANEL BELOW"
1152 PRINT " RED LIGHT ON RIGHT SIDE OF KEYBOARD"
1154 PRINT " TO ASK ABOUT DRUGS AND PREGNANCY ";
1160 FOR J=1 TO 2000:IF PEEK(53279)=6 THEN 3000
1170 NEXT J:GOTO 1010
2000 REM SUBROUTINES
2120 PRINT :PRINT
2122 PRINT " ENTER NUMBER OF TOPIC"
2123 PRINT " Your Choice is ";
2130 FOR J=1 TO 3000
2140 IF PEEK(764)=31 THEN POKE 764,255:K$="1":PRINT K$:RETURN
2150 IF PEEK(764)=30 THEN POKE 764,255:K$="2":PRINT K$:RETURN
2160 IF PEEK(764)=26 THEN POKE 764,255:K$="3":PRINT K$:RETURN
2170 IF PEEK(764)=24 THEN POKE 764,255:K$="4":PRINT K$:RETURN
2172 IF PEEK(764)=29 THEN POKE 764,255:K$="5":PRINT K$:RETURN
2180 NEXT J:GOTO 1010
2220 IF (ASC(K$)<49) OR (ASC(K$)>50) THEN PRINT " USE NUMBERS 1 TO 2 ":K$="N":PRINT :RETURN
2230 IF (ASC(K$)<49) OR (ASC(K$)>51) THEN PRINT " USE NUMBERS 1 TO 3 ":K$="N":PRINT :RETURN
2240 IF (ASC(K$)<49) OR (ASC(K$)>52) THEN PRINT " USE NUMBERS 1 TO 4 ":K$="N":PRINT :RETURN
2250 IF (ASC(K$)<49) OR (ASC(K$)>53) THEN PRINT " USE NUMBERS 1 TO 5 ":K$="N":PRINT :RETURN
2280 RETURN
2290 PRINT :PRINT :PRINT " ENTER C TO MAKE A CHOICE"
2292 PRINT " ENTER R TO RETURN TO THE PREVIOUS"
2294 PRINT " LIST TO MAKE ANOTHER CHOICE"
2300 PRINT " ENTER Q TO QUIT ";
2320 FOR J=1 TO 3000
2330 IF PEEK(764)=40 THEN POKE 764,255:K$="R":PRINT K$:PRINT :RETURN
2340 IF PEEK(764)=18 THEN POKE 764,255:K$="C":PRINT K$:RETURN
2345 IF PEEK(764)=37 THEN POKE 764,255:K$="M":PRINT K$:RETURN
2350 IF PEEK(764)=47 THEN POKE 764,255:GOTO 1010
2360 NEXT J
2370 GOTO 1010
3000 REM DRUG LIST "
3010 GRAPHICS 0:SETCOLOR 2,9,4
3020 PRINT :PRINT " Copyright 1983 G.R.Zucconi M.D.":PRINT
3030 PRINT " ANY DRUG SHOULD BE AVOIDED"
3032 PRINT " DURING PREGNANCY UNLESS ABSOLUTE-"
3034 PRINT " LY NECESSARY. YOU CAN SEE WHAT"
3036 PRINT " EFFECT EACH DRUG HAS BY CHOOSING"
3038 PRINT " ONE FROM THE LIST.":PRINT
3090 PRINT " 1. ALCOHOL"
3100 PRINT " 2. EPILEPTIC OR SEIZURE DRUGS"
3110 PRINT " 3. BLOOD THINNERS"
3120 PRINT " 4. LITHIUM"
3130 PRINT " 5. HORMONES AND BC PILLS"
3131 PRINT :PRINT " FOR MORE DRUGS, ENTER M"
3132 GOSUB 2290:IF K$="R" THEN 3000
3133 IF K$="M" THEN 3160
3134 GOSUB 2120:GOSUB 2250

```

Listing 1 continued on page 110

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Listing 1 continued:

```

3140 IF K$="N" THEN 3000
3150 ON VAL(K$) GOSUB 3390,3500,3640,3740,3840
3160 PRINT "":PRINT :SETCOLOR 2,3,2:SETCOLOR 4,11,4
3170 PRINT "      DRUG LIST CONTINUED":PRINT
3180 PRINT "  1. ANTIBIOTICS"
3190 PRINT "  2. ANESTHETICS"
3200 PRINT "  3. DRUGS FOR NAUSEA"
3210 PRINT "  4. TRANQUILIZERS, SEDATIVES"
3220 PRINT "  5. ASPIRIN"
3230 PRINT :PRINT " FOR MORE DRUGS, ENTER M"
3240 GOSUB 2290:IF K$="R" THEN 3000
3250 IF K$="M" THEN 3280
3260 GOSUB 2120:GOSUB 2250
3270 IF K$="N" THEN 3160
3275 ON VAL(K$) GOSUB 3960,4080,4190,4330,4440
3280 PRINT "":PRINT :SETCOLOR 2,6,2:SETCOLOR 4,15,6
3290 PRINT "      DRUG LIST CONTINUED":PRINT
3300 PRINT "  1. DRUGS TO BE AVOIDED NEAR"
3302 PRINT "      THE END OF PREGNANCY"
3304 PRINT "  2. SMOKING"
3310 PRINT "  3. X-RAYS"
3320 PRINT "  4. FACTORS KNOWN TO CAUSE"
3330 PRINT "      DEFORMITIES IN THE FETUS"
3335 PRINT "  5. STREET DRUGS"
3340 PRINT :PRINT " THIS IS THE END OF THE DRUG LIST"
3350 GOSUB 2290:IF K$="R" THEN 3160
3360 GOSUB 2120:GOSUB 2250
3370 IF K$="N" THEN 3280
3375 ON VAL(K$) GOSUB 4590,4690,4820,4960,5150
3380 REM
3390 PRINT "":PRINT
3400 PRINT "      ALCOHOL ":PRINT :PRINT
3410 PRINT "  RISK OF MALFORMATION INCREASES"
3420 PRINT "  WITH THE AVERAGE DAILY INTAKE.":PRINT :PRINT
3430 PRINT "  THERE IS ONE CHANCE IN TEN OF A"
3440 PRINT "  DEFORMITY IF YOU HABITUALLY HAVE"
3450 PRINT "  MORE THAN ONE OR TWO DRINKS PER"
3460 PRINT "  DAY FOR MOST OF THE PREGNANCY.":PRINT :PRINT
3470 PRINT "  HEAVY DRINKERS HAVE ONE CHANCE IN"
3480 PRINT "  FOUR OF HAVING A DEFORMED BABY."
3490 GOSUB 2290:IF K$="R" THEN 3000
3500 PRINT "":PRINT
3510 PRINT "      EPILEPTIC OR SEIZURE DRUGS ":PRINT
3520 PRINT "  THERE IS A 2 TO 3 PER CENT RISK"
3530 PRINT "  OF MALFORMATION IN WOMEN TAKING"
3540 PRINT "  THESE DRUGS.":PRINT
3550 PRINT "  PHENOBARBITAL,AND BARBITURATES IN"
3560 PRINT "  GENERAL,HAVE BEEN USED FOR A LONG"
3570 PRINT "  TIME, AND IT SEEMS UNLIKELY THAT"
3580 PRINT "  THEY HAVE ANY IMPORTANT EFFECT.":PRINT
3590 PRINT "  DILANTIN HAS A LOWER RISK THAN"
3600 PRINT "  TRIDIONE AND PARADIONE.":PRINT
3610 PRINT "  THE RISKS OF THE NEWER DRUGS LIKE"
3620 PRINT "  TEGRETOL AND DEPAKENE ARE UNKNOWN."
3630 GOSUB 2290:IF K$="R" THEN 3000
3640 PRINT "":PRINT
3650 PRINT "      BLOOD THINNERS ":PRINT
3660 PRINT "  COUMARIN SHOULD NOT BE USED IN"
3670 PRINT "  PREGNANCY. IT CAN CAUSE FETAL AB-"
3680 PRINT "  NORMALITIES EVEN LATE IN THE PRE-"
3690 PRINT "  GNANCY. IT CAN ALSO CAUSE BLEED-"
3700 PRINT "  ING IN THE FETUS AND THE NEWBORN.":PRINT
3710 PRINT "  IF AN ANTICOAGULANT IS NEEDED,THE"
3720 PRINT "  DRUG OF CHOICE IS HEPARIN."
3730 GOSUB 2290:IF K$="R" THEN 3000
3740 PRINT "":PRINT
3750 PRINT "      LITHIUM ":PRINT :PRINT
3760 PRINT "  THE EVIDENCE CURRENTLY AVAILABLE"
3770 PRINT "  SUGGESTS THAT LITHIUM IS PROBABLY"
3780 PRINT "  A CAUSE FOR MALFORMATIONS.":PRINT
3790 PRINT "  THE EVIDENCE IS SUFFICIENT TO"
3800 PRINT "  JUSTIFY AVOIDING LITHIUM DURING"

```

Listing 1 continued on page 113

Smartmodem 300, 1200, and 1200B are FCC approved in the U.S. and DOC approved in Canada.

Smartmodem 1200B. (Includes telephone cable. No serial card or separate power source is needed.)



Smartcom II communications software.

NOTE: Smartmodem 1200B may also be installed in the IBM Personal Computer XT or the Expansion Unit. In those units, another board installed in the slot to the immediate right of the Smartmodem 1200B may not clear the modem; also, the brackets may not fit properly. If this occurs, the slot to the right of the modem should be left empty.

And, in addition to the IBM PC, Smartcom II is also available for the IBM Personal Computer XT, COMPAQ Portable, Corona Portable PC, Columbia MPC, DEC Rainbow 100, Xerox 820-II, and Kaypro II personal computers.*

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Listing 1 continued:

```

3810 PRINT " THE FIRST THREE MONTHS OF THE"
3820 PRINT " PREGNANCY."
3830 GOSUB 2290:IF K$="R" THEN 3000
3840 PRINT "}"
3850 PRINT "          HORMONES AND BC PILLS ":PRINT :PRINT
3860 PRINT " THE SMALL AMOUNTS OF PROGESTOGEN"
3870 PRINT " IN BIRTH CONTROL PILLS ARE NOT"
3880 PRINT " LIKELY TO CAUSE MALFORMATIONS.":PRINT
3890 PRINT " STUDIES HAVE BEEN CONTRADICTORY"
3900 PRINT " AND CONFUSING,BUT IF THERE IS ANY"
3910 PRINT " RISK, IT MUST BE SMALL.":PRINT
3920 PRINT " EXPDURE TO DIETHYLSTILBESTEROL"
3930 PRINT " CAN CAUSE CANCER OF THE VAGINA IN"
3940 PRINT " FEMALE OFFSPRING."
3950 GOSUB 2290:IF K$="R" THEN 3000
3960 PRINT "}"
3970 PRINT "          ANTIBIOTICS ":PRINT
3980 PRINT " ALMOST ALL DRUGS USED TO TREAT"
3990 PRINT " INFECTIONS ARE SAFE IN PREGNANCY.":PRINT
4000 PRINT " DRUGS CONTAINING TRIMETHOPRIM AND"
4010 PRINT " PYRIMETHAMINE MAY CAUSE MALFORMA-"
4020 PRINT " TIONS.BRAND NAMES FOR THESE DRUGS"
4030 PRINT " ARE: BACTRIM, SEPTRA, PROLOPRIM,"
4040 PRINT " TRIMPLEX AND DARAPRIM.":PRINT
4050 PRINT " TETRACYCLINE CAN CAUSE STAINING"
4060 PRINT " OF TEETH, AND SHOULD BE AVOIDED."
4070 GOSUB 2290:IF K$="R" THEN 3160
4080 PRINT "}"
4090 PRINT "          ANESTHETICS ":PRINT :PRINT
4100 PRINT " ANESTHETICS FOR SURGERY OR DENTAL"
4110 PRINT " WORK DO NOT INCREASE THE RISK FOR"
4120 PRINT " HAVING A DEFORMED INFANT.":PRINT
4130 PRINT " WOMEN WHO WORK IN THE OPERATING"
4140 PRINT " ROOM OR ARE EXPOSED TO GAS ANES-"
4150 PRINT " THETICS,ESPECIALLY NITROUS OXIDE,"
4160 PRINT " OVER A LONG PERIOD OF TIME, ARE"
4170 PRINT " AT INCREASED RISK FOR ABORTION."
4180 GOSUB 2290:IF K$="R" THEN 3160
4190 PRINT "}"
4200 PRINT "          DRUGS FOR NAUSEA ":PRINT
4210 PRINT " MANY STUDIES INVOLVING MANY HUN-"
4220 PRINT " DREDS OF WOMEN HAVE FAILED TO"
4230 PRINT " SHOW AN INCREASED INCIDENCE OF"
4240 PRINT " MALFORMATIONS.":PRINT
4250 PRINT " IN SPITE OF OVERWHELMING SCIENTI-"
4260 PRINT " FIC EVIDENCE AND 27 YEARS OF USE,"
4270 PRINT " A RECENT COURT JUDGEMENT HAS CAU-"
4280 PRINT " SED PUBLIC ALARM OVER THE SAFETY"
4290 PRINT " OF THE MOST EFFECTIVE OF THESE"
4300 PRINT " DRUGS IN PREGNANCY, BENEDICTIN,"
4310 PRINT " AND ITS MANUFACTURE HAS BEEN"
4315 PRINT " DISCONTINUED."
4320 GOSUB 2290:IF K$="R" THEN 3160
4330 PRINT "}"
4340 PRINT "          TRANQUILIZERS, SEDATIVES ":PRINT :PRINT
4350 PRINT " TWO MAIN STUDIES HAVE PRODUCED"
4360 PRINT " CONFLICTING RESULTS, BUT RISK, IF"
4370 PRINT " IT EXISTS, IS SMALL.":PRINT
4380 PRINT " THE SAME THING CAN BE SAID ABOUT"
4390 PRINT " MOOD ELEVATORS OR ANTIDEPRESSANTS,"
4395 PRINT " WITH THE EXCEPTION OF LITHIUM.":PRINT
4400 PRINT " BARBITURATES HAVE BEEN IN USE FOR"
4410 PRINT " A LONG TIME AND ARE CONSIDERED"
4420 PRINT " SAFE DURING PREGNANCY."
4430 GOSUB 2290:IF K$="R" THEN 3160
4440 PRINT "}"
4450 PRINT "          ASPIRIN ":PRINT
4460 PRINT " THERE IS NO ASSOCIATION BETWEEN"
4470 PRINT " ASPIRIN AND MALFORMATIONS.":PRINT
4480 PRINT " HOWEVER,ASPIRIN SHOULD BE AVOIDED"
4490 PRINT " AFTER THE FIRST THREE MONTHS OF"
4500 PRINT " PREGNANCY BECAUSE IT CAN CAUSE"
4510 PRINT " THE PREGNANCY TO BE PROLONGED IF"

```

Listing 1 continued on page 114

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Listing 1 continued:

```

4520 PRINT " TAKEN IN HIGH DOSES.":PRINT
4530 PRINT " ASPIRIN MAY ALSO PROLONG LABOR,"
4540 PRINT " AND IF TAKEN WITHIN ONE WEEK OF"
4550 PRINT " DELIVERY, CAN CAUSE BLEEDING PROB-"
4560 PRINT " LEMS IN THE MOTHER AND INFANT."
4570 GOSUB 2290:IF K$="R" THEN 3160
4590 PRINT "}"
4600 PRINT "          DRUGS TO BE AVOIDED          "
4610 PRINT "          NEAR THE END OF PREGNANCY ":PRINT :PRINT
4620 PRINT " SULFA DRUGS AND ASPIRIN CAN LEAD"
4630 PRINT " TO JAUNDICE IN THE NEWBORN.":PRINT
4640 PRINT " THE FOLLOWING DRUGS CAN LEAD TO"
4650 PRINT " RUPTURE OF THE BABY'S RED BLOOD"
4660 PRINT " CELLS CAUSING ANEMIA: DRUGS FOR"
4670 PRINT " MALARIA, PHENACETIN (APC), SULFA"
4675 PRINT " AND NITROFURANTOIN."
4680 GOSUB 2290:IF K$="R" THEN 3280
4690 PRINT "}"
4700 PRINT "          SMOKING          ":PRINT
4710 PRINT " SMOKING IS KNOWN TO BE A POSSIBLE"
4720 PRINT " CAUSE OF PREMATUREITY, AND IT MAY"
4730 PRINT " ALSO INCREASE THE RISK OF SPONTA-"
4740 PRINT " NEOUS ABORTION.":PRINT
4750 PRINT " CHEWING TOBACCO AND NICOTINE CHEW-"
4760 PRINT " ING GUM SHOULD NOT BE USED DURING"
4770 PRINT " PREGNANCY.":PRINT
4780 PRINT " CUTTING BACK ON THE NUMBER OF CI-"
4790 PRINT " GARETTES SMOKED WILL HELP, IF YOU"
4800 PRINT " CANNOT STOP ALTOGETHER."
4810 GOSUB 2290:IF K$="R" THEN 3280
4820 PRINT "}"
4830 PRINT "          X-RAYS          ":PRINT :PRINT
4840 PRINT " THE AMOUNT OF RADIATION ABSORBED"
4850 PRINT " FROM CHEST OR DENTAL X-RAYS IS"
4860 PRINT " TOO SMALL TO HAVE ANY EFFECT ON"
4870 PRINT " FETAL DEVELOPMENT. EVEN X-RAYS TO"
4890 PRINT " THE PELVIS IN EARLY PREGNANCY DO"
4900 PRINT " NOT PRODUCE ENOUGH RADIATION TO"
4910 PRINT " CAUSE ANY MALFORMATION.":PRINT
4920 PRINT " DURING PREGNANCY, HOWEVER, A LEAD"
4930 PRINT " SHIELD OR APRON SHOULD BE USED AS"
4940 PRINT " A PRECAUTION."
4950 GOSUB 2290:IF K$="R" THEN 3280
4960 PRINT "}"
4970 PRINT "          FACTORS KNOWN TO CAUSE          "
4980 PRINT "          DEFORMITIES IN THE FETUS ":PRINT
4990 PRINT " MORE THAN 65% OF MALFORMATIONS"
5000 PRINT " HAVE UNKNOWN CAUSES, BUT PROBABLY"
5010 PRINT " MOST HAVE MULTIPLE CAUSES, ONLY"
5020 PRINT " 10% OF WHICH MAY BE ATTRIBUTED TO"
5030 PRINT " DRUGS. THE OTHER 25% ARE DUE TO"
5040 PRINT " CHROMOSOME OR GENETIC PROBLEMS.":PRINT
5050 PRINT " EVEN THALIDOMIDE PRODUCES DEFECTS"
5060 PRINT " IN LESS THAN 25% OF EXPOSED OFF-"
5070 PRINT " SPRING.":PRINT
5080 PRINT " CYTOTOXIC DRUGS USED FOR CANCER"
5090 PRINT " TREATMENT ARE THE OTHER CLASS OF"
5100 PRINT " DRUGS THAT CAUSE MALFORMATIONS."
5140 GOSUB 2290:IF K$="R" THEN 3280
5150 PRINT "}"
5160 PRINT "          STREET DRUGS          ":PRINT
5170 PRINT " PREMATUREITY AND LOW BIRTH WEIGHT"
5180 PRINT " ARE COMMON AND INFANT MORTALITY"
5190 PRINT " IS INCREASED WITH USE OF HEROIN.":PRINT
5200 PRINT " WITHDRAWAL EFFECTS AFTER DELIVERY"
5210 PRINT " OR EVEN WHILE IN UTERO CAN CAUSE"
5220 PRINT " FETAL DISTRESS AND DEATH.":PRINT
5230 PRINT " NONE OF THE COMMON STREET DRUGS,"
5240 PRINT " INCLUDING MARIJUANA, ARE KNOWN TO"
5250 PRINT " CAUSE ANY FETAL MALFORMATIONS."
5260 GOSUB 2290:IF K$="R" THEN 3280
5270 PRINT "          YOU HAVE REACHED THE END          "
5280 PRINT "          OF THE PROGRAM          "
5290 GOSUB 2290:IF K$="R" THEN 3280
5300 GOTO 1010

```


your patients access to the computer, you may find this type of program useful in another way; it can be used by your staff to answer questions posed by patients.

Letting a nurse or receptionist handle simple medical questions is a common practice, but the aptness and correctness of the response may vary considerably depending on the training and experience of the person answering the questions. A program such as listing 1, used by the office staff to answer patient queries, can, in effect, make use of the expert knowledge and judgment of a physician, even in his or her absence.

In essence, the program and not the staff person supplies the answers. Through the program, the logic and rules of the expert applied to the base of medical knowledge control the response to the questions. The patients receive the answers you would have given, just as if you were speaking to them directly. Full diagnostic programs for large computers are already in operation in some medical centers. These programs, known as "expert" systems, function in much the same way. By interrogating for signs and symptoms and acting on these with rules devised by professionals, the systems arrive at the most likely diagnoses.

Adaptability to Other Computers

The Drugs in Pregnancy program was written in Atari BASIC and requires less than 13K bytes of memory. I chose the Atari because of its inexpensive price and rugged construction, and because it could be used without difficulty by anyone in the waiting room. The program can be easily rewritten in versions of BASIC for other computers. Instructions helpful for such conversions are given in the next section of this article.

The program structure is not limited to any particular field or topic. By changing the wording of the choices and the responses, you can change the topic to heart disease, exercise physiology, or any other area. By retaining its structure, the program will continue to operate as before, adapted to the new subject.

Converting an Atari Program

If you are converting this program for use on a computer other than the Atari, you need to change or eliminate some of the Atari-specific statements and commands. These are mostly graphic commands and symbols that differ from those of other computers. In the program listed, they serve to change the colors of the background and the borders of the screen display. You could delete all the graphic statement lines in the program, and it would still convey the information.

I chose the Atari because of its inexpensive price and rugged construction.

In designing this program, I devoted particular attention to making it user-proof. Envisioning the user as someone with no previous experience in operating a computer, and considering the environment for the program's intended use, I attempted to make it as difficult as possible to crash the program. The program had to continue operation, or right itself, if the user committed a mistake. This goal was achieved to a point.

Practically all the keys are rendered inoperable except the few that are needed for the user to make choices in the program. Because the office computer does not operate with a disk system, I found no practical way to disable the Break or the System Reset keys other than to cover them with the message, "Do NOT press this key." All responses to the user choices are segregated into timed loops so that if a preset time limit is exceeded, the program will automatically restart at the beginning. This prevents the program from freezing at a particular place if the user abandons it before its conclusion.

Most of the PEEK and POKE statements are used to carry out the fool-proofing. Since the PEEKs and POKEs are peculiar to the Atari, if you need this kind of crash prevention, you will have to devise methods

for your own computer. The following Atari commands and functions are explained in detail so that you can convert them to the equivalent functions on your computer.

The SETCOLOR statement chooses a particular hue and luminance. The question mark (?) is an abbreviated form of the PRINT statement. PRINT #6 is a graphic statement that produces enlarged characters on the screen. The GRAPHICS command selects one of various graphic modes. Since the Atari GRAPHICS command also clears the screen, whenever you see this command in the program you should substitute your computer's command to clear the screen. Another Atari command also clears the screen: a PRINT statement followed by an arrow between double quotes. However, since most printers cannot print this arrow character, another symbol for the clear-screen command appears in the printout of the program listing. That symbol is "}" (right brace). Wherever you come across PRINT "}" in program listing 1, you should also substitute your computer's clear-screen code.

Explanation of the Program

Atari BASIC requires dimensioning all string variables for the maximum length of the string. The DIM statement, line 1010 CLR :DIM K\$(1), reserves a certain number of memory locations for the string variable K\$. Each character in a string requires 1 byte in memory. CLR clears the memory of all previously dimensioned strings, arrays, and matrices.

Ordinarily, luminescence is reduced and the colors are rotated to protect the screen if no one accesses the keyboard after nine minutes. The POKE command, line 1020 POKE 77,0, disables this function since the keyboard frequently goes unused for this period of time. Instead, the program changes screens automatically every 15 to 20 seconds while unattended, so this protection feature is not needed.

Line 1080 sets up a loop to keep the display on the screen for 15 seconds and allows the user to break out of the loop to start the main program by

pressing the Start key. The PEEK command in this line monitors the Atari console switches. When the Start key is pressed, the program branches to line 3000. If the Start key is not activated within 15 seconds, the loop terminates and the program goes on to the next statement.

Line 1160 performs the same function for the second screen display, and line 1170 returns to the first screen if the Start key is not activated.

Lines 2000 to 2370 are subroutines and will be discussed in the sections of the program that call them.

Line 3000 is the beginning of the main program. A brief explanatory message is displayed on the screen followed by a menu of five drugs and an option to go on to a list of additional drugs.

Line 3132 calls subroutine 2290. (This input subroutine ends at 2370 unless an exit is made at one of the earlier lines.) The subroutine displays a menu of choices. A timing loop is set up as before, while the PEEK 764 statements read the value of the last key pressed. This function is similar to that of the INKEY statement in other versions of BASIC. The computer responds when the key is pressed; the user need not hit the Return or Enter key. The POKE statement restores the PEEK location to its normal value of 255, and the character entered is stored in the string

variable K\$. If the character "C" is entered, indicating that the user wishes to choose one of the drugs listed, the program returns to line 3132 and falls through the next two statements to line 3134, where the program control shifts to the subroutine starting on line 2120.

The subroutine at line 2120 prompts the user to enter a number and sets up another timed loop. The PEEK 764 statements that follow again scan the keyboard for the numbers 1 through 5, store the chosen number in the string variable K\$, and then return the program to line 3134. Lines 2140 to 2172 will not respond to any entry except the numbers 1 through 5. This is a further safeguard against the program's being crashed by an incorrect keystroke. Line 2180 restarts the program if keys 1 through 5 are not pressed within 15 seconds.

The second statement on line 3134 calls the subroutine at line 2250. This subroutine checks to see if the keyboard entry was a number from 1 to 5. If not, line 2250 displays an error message and sets an error flag in variable K\$; this returns the user to the menu again for another input in line 3140.

If all has gone well up to this point, K\$ contains the number associated with the drug of choice. The conversion of this string value to a numerical value with the VAL function in

line 3150 causes the program to branch to the appropriate routine with the ON GOSUB statement. If "R" was entered as a choice, the program will return to the previous menu. If "M" was the choice, the program will display the names of more drugs by branching to the next list of drugs.

The many subroutines, nested several layers deep, may make following the logic of the program difficult. However, the memory stack keeps track of all the subroutine calls and returns each one to the proper address. The advantage of such a method is that the user can move from the beginning of the program to the end in sequence, or jump back and forth anywhere in between, without being restricted to a one-way path.

The remainder of the program contains the text for the choices available to the user and further information on the topic chosen. By changing the textual content but retaining the form, structure, and logic of the program, you can rewrite the contents to deal with any topic that lends itself to a list of choices with a response for each one. ■

George Zucconi, M.D., has a private OB/GYN practice in San Diego, California. He has written numerous articles and delivered lectures on the topic of computers and medicine. He can be reached at 7808 El Cajon Blvd., La Mesa, CA 92041.

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Pasdos, a utility program written in Pascal and assembly language to allow transfers of files between DOS 3.3 and UCSD Pascal. Features include automatic display of either directory, automatic text-file formatting, code-file generation, and high-resolution picture transfer between printer and computer. Built-in demonstrations and documentation enable smooth conversions. For the II; floppy disk, \$39.95. Linnton Systems, POB 17612, Portland, OR 97217.

Scientific Plotter, Version II, a graphing program for plotting scientific, engineering, and business data. Superimpose more than one data set on the same graph easily with 20 plotting symbols. You control axis position, grid size, and scaling intervals. A stand-alone utility program prints labels on any high-resolution picture. For II, II Plus and IIe; floppy disk, \$50. Interactive Microware Inc., POB 771, State College, PA 16801.

Talking Blissapple, a tri-modal program written in a combination of machine language and FORTH that is designed for communicatively disabled children. It functions by interfacing with custom keyboards to act as a communication/writing aid. These children can write with Blissymbols and have their messages and stories displayed on a terminal, spoken, or printed on the printer. For II and II Plus; floppy disk, \$35. Trace Research and Development Center, 314 Waisman Center, 1500 Highland Ave., Madison, WI 53706.

Time is Money, a personal accounting package that can double for a small-business financial-management system. You can balance your checkbook, calculate and

monitor budgets, discern net worth, and record tax-deductible expenses without bookkeeping or accounting skills. You can track up to 240 income types, 240 income sources, 240 expenses, and 240 assets and liabilities. Full report generation and graphics capabilities are a few of the instructions that require a single keystroke. For II, II Plus, and IIe; floppy disk, \$100. Turning Point Software, 11A Main St., Watertown, MA 02172.

Tom Thumb, a reading program for preschoolers and first graders. This adaptation of the fairy tale by the Brothers Grimm improves reading, vocabulary, and comprehension skills. Features include self-paced reading levels, multiple vocabulary levels, easy-to-use software, color graphics, and special character sets. For II Plus and IIe; floppy disk, \$29.95. International Software Systems, POB 5427, Richmond, VA 23220.

Trompers, an arcade-type game. Due to a skip in Arnold Strump's shortwave radio, too many little creatures from the planet Tromp are falling from the sky into his domain. You have five levels in which to help old Arn catch them all and score the most points you can. For II, II Plus, and IIe; floppy disk, \$29.95. Avant-Garde Creations Inc., POB 30160, Eugene, OR 97403.

Unprintable Physics, an educational program for science and engineering students. You can use up to 32 simulations, demonstrations, examples, and quizzes of mathematical methods, mechanics, thermodynamics, electromagnetism, and wave phenomena. Learn modern physics in ways it cannot be taught by books. For II, II Plus, and IIe; floppy disk,

\$29.95. Prentice-Hall, Rt. 9W, Englewood Cliffs, NJ 07632.

Atari

Gridrunner, an arcade-type game. As a pilot of an air-battleship, you try to stop the droids from attacking the orbiting solar-power station. Destroy pods, droid segments or leaders, and avoid the releases of plasma and ever-increasing attack waves. Requires a joystick. For the 400/800; cartridge, \$29.95. Human Engineered Software, 150 North Hill Dr., Brisbane, CA 94005.

Omnitrend's Universe, a three-dimensional tactical strategy game. You are a starship captain in search of the lost hyperspace booster. Save the civilization, become a hero, and win a fortune if you succeed. For 400/800 and 1200; floppy disks, \$89.95. Omnitrend Software, 8 Huckleberry Lane, West Simsbury, CT 06092.

CP/M

Compas Pascal, a Pascal compiler. This superset of standard Pascal is a one-pass compiler that generates machine code quickly. The interactive editor is command compatible with Wordstar. It includes such features as overlays, dynamic strings, random-access files, and more. Floppy disk, \$440. K. J. Computer Services, POB 66, Mentone, Victoria 3194, Australia.

FORTRAN Relabel, a label-renumbering program. All the numeric labels in FORTRAN programs containing statements and line references can be renumbered

using this program. Subroutines, function programs, and Microsoft EDIT80 line numbers, if present, are processed automatically. You specify the ASCII filename, the desired new label beginning, and increment. Floppy disk, \$29.95. Cleydale Engineering, POB 784, Dahlgren, VA 22448. (This program's description was listed incorrectly in the March "Software Received," page 463. We regret any inconveniences this may have caused.)

ICAMS, an integrated condominium- and apartment-management system. You can perform property-management calculations with features that include semi-automatic billing and payment receipts, account updates, and 18 current reports. It can search for specific word clues and customization is an option. Floppy disk, \$1195. Advanced Management Approach Inc., POB 8576, Calabasas, CA 91302.

LeBug, a Z80-based assembly-level debugging tool. With this program, breakpoints do not need to be removed to resume execution because they are already transparent. You can manipulate arithmetic and symbolic expressions, address expressions using register contents, and benefit from nondestructive memory tests, error codes, and built-in disk protection from overwriting. Floppy disk, \$80. Lehey Microcomputer Systems, Postfach 145, 6365 Rosbach 1, Germany.

Mailer, Version 1.2, a mailing-list management package running on the CP/M 2.2 operating system. This program can read in address files created by word-processing and mailing programs to create new files. A screen form simplifies data entry and updating, delimit-

(text continued from page 68)
quencies should be used. A general rule would be to use as high a bandwidth as possible but settle for any monitor that you visually judge to have a satisfactory display.—Steve

SHUGART SA-400s FOR APPLES

Dear Steve,

I have an Apple II with one 5¼-inch Apple disk drive. I'd like to use my Apple with a

Shugart SA-400 drive. I know these components are incompatible, but can you show me how to create a proper interface? Thank you.

CLAUDIO PUGLIESE
Buenos Aires, Argentina

A printed-circuit board and complete instructions for modifying a Shugart SA-400 disk drive for use with your Apple II can be obtained for \$29.95 from R & D Electronics, 100 East Orange-thorpe, Anaheim, CA 92801, (714) 773-0240.

Several traces on the SA-400 printed-circuit board must be cut and several jumper wires installed in addition to the interface-circuit board that connects between the Apple II cable and the 34-pin edge connector on the SA-400.

It is important to note that the SA-400 and this modification draw about 450 milliamperes from the Apple II's +5-V supply. If your system has many expansion cards, you may want to consider a separate power supply.—Steve

REPLACING 4116s WITH 4164s

Dear Steve,

I have an Atari 400 with the 16K-byte memory board. I would like to know if it is possible to change the 4116 memory chips to 4164 chips, add some jumpers, and have a 64K-byte board. Thank you for your help.

RANDY B. BUMGARNER
Taylorsville, NC

In theory, upgrading from the 4116 to the 4164 is as simple as adding a few jumpers if the memory system was originally designed to do this. In most cases, it is more complicated.

The 4116 used a three-voltage power-supply system that was changed to a single +5-V supply for the 4164. This left two extra pins that could be used for addressing. On the 4164, only one of these pins was needed to upgrade the chip to a 64K-byte part. The following chart shows the reassignment of the pins:

Pin	4116	4164
1	-5 V	N.C.
8	+12 V	+5 V
9	+5 V	A7

Pin 1 can be handled easily by cutting the -5-V trace on your board that goes to your memory array. Pin 8 can be reassigned by cutting the +5-V and +12-V traces to your memory array and jumpering the trace from pin 8 to the +5-V supply. The trace from pin 9 now will be your new address line, and all decoupling capacitors on this line in your memory array must be removed.

That was the easy part. Now the memory address multiplexing portion of your board must be modified to bring in the new address line A7. Because I am not familiar with the addressing used on the Atari board, I can only suggest that you look over that portion of the circuit carefully before making any changes. An error here will be disastrous. You also must be careful that your new 64K-byte memory does not conflict with any other memory already assigned in the system, for example, any ROM or memory-mapped I/O devices.—Steve

REAL-TIME CLOCK THOUGHTS

Dear Steve,

I'd like to suggest a project for your Circuit Cellar.

I just after a real-time clock for my IBM PC, but all my expansion slots are full of other
(text continued on page 74)



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Archon

In this
innovative
game,
animated
pieces vie
for control
of a disputed
square

BY GREGG WILLIAMS

I like games—board games, video games, word games, any kind. I browse in game and video stores the way most people browse in bookstores. I play and analyze the games I see (a lot of which come in to BYTE) and buy the few that are worth the money. I've even tried designing different kinds of games. I mention all this only to lend weight to what I'm about to say: that Archon (pronounced "ARK-on"), from Electronic Arts (see photo 1), is one of the best computer games I've ever played.

What makes a computer game good? For me, an original game concept, a strong design, and high repeat playability are all important, but I also value something many computer games don't address: appropriateness to the computer format. In other words, whether the game uses the computer to create something that couldn't be done without a computer. Sophisticated interactive adventures put the computer to good use; computer cribbage games do not.

Archon is special because it weds the strategy- and the arcade-style video game genres, and that makes for a very powerful synergistic combination. The playing pieces are mythological figures with different characteristics (photo 1). When one piece moves onto a square occupied by an enemy piece, the playing board becomes a battlefield, where the pieces battle to the death in best arcade fashion (photo 2). The object of the game is to capture five "power points" on the board or to eliminate all enemy pieces. Whether you play against another person or against the computer, you must use both strategy and arcade skills to win.

(My praise is for the Atari version of Archon. Electronic Arts is adapting the game to other machines, but I am not sure the game will play as well on other machines.)

THE BOARD

The pieces appear on a 9 by 9 playing board. Some squares are permanently dark, others are permanently light, and 33 of them (called *luminance squares*) continuously change from light to dark (through four shades of gray) and back again, one change per turn. There are five power points, one in the exact center and

one in the middle of each edge of the square board. The power points are also luminance squares; the other luminance squares trace a path from any power point to any other power point (making for a plus-sign-inside-a-diamond shape). When the game begins, the light pieces occupy the first two columns of squares and the dark occupy the last two.

THE PIECES

Each player has 18 pieces, two columns of nine each. The initial layout resembles a chess board; the innermost column consists mostly of pawn-like pieces (knights for the light side, golems for the dark), leaving the more powerful pieces behind them.

Each player has eight kinds of pieces, each with its own movement (walking, flying, or teleporting) and method of attack (throwing an object, thrusting with a short sword, or emitting a destructive circular aura). Players control piece selection, movement, and combat with joysticks. Each piece also has a fixed attack force (how damaging the attack is), attack speed (how fast the attack "moves"), attack interval (how long until the piece can attack again), and lifespan (how resistant the piece is to an attack). For example, the phoenix can fly up to five squares per turn, attacks by radiating a fireball, and has a long lifespan; its fireball is very powerful but radiates outward slowly and takes a long time to build up.

One piece on each side (the wizard on the dark side, the sorceress on the light) can cast a spell instead of moving. There are seven spells, and each can be used only once. Each spell is potent (for example, one revives a selected piece that has been killed), but you shouldn't necessarily hoard them for later use—you lose all remaining spells if your spell-casting piece gets killed.

The rule book offers a lot of information about the pieces, but be sure to read the Archon Command Summary Card packaged with the program disk. It contains information that doesn't appear elsewhere in the package.

(text continued on page 322)

.....
Gregg Williams is a senior technical editor at BYTE. He can be reached at POB 372, Hancock, NH 03449.

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REVIEW: ARCHON

AT A GLANCE

Name

Archon (Atari version)

Type

Arcade/strategy game

Manufacturer

Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
(415) 571-7171

Price

\$40

Authors

Anne Westfall, Jon Freeman, Paul Reiche III

Format

One 5¼-inch floppy disk

Number of Players

One or two

Language

Assembly language

Computers

Atari home computers with 32K bytes of memory (expanded Atari 400 and 600XL, standard Atari 800, 800XL, and 1200XL) (Also available for Apple and Commodore computers and the IBM PC.)

Documentation

A 14-page rule book, reference and command summary cards

Audience

People who want action, thinking, and human interaction in a video game

(text continued from page 321)

COMBAT

You are advised to choose the time and place of your combat well, because it is influenced by your opponent's piece, the combat history of both pieces, and the color of the square. You have an edge if your piece is "fresh" (i.e., unwounded), inherently powerful, or if it is fighting on a square of its own color. During combat, vertical bars called *lifelines* appear on both sides of the combat screen. These decrease in size every time a piece is hit (see photo 2) and tell you how close your piece is to being destroyed. The wounds from a previous battle leave a piece weakened until sufficient time passes or a "heal" spell is cast; pieces resting on power points heal faster than those on ordinary squares. Because pieces can be weakened by combat, several weak pieces, with some skill on the part of the player, can successively weaken and destroy a strong piece.

Combat is also affected by irregular barriers that appear, fade, and disappear cyclically. Depending on its solidity, a barrier can allow, retard, or prevent piece or projectile movement. To survive in the battlefield, you must make the best use of these barriers.

A final factor, square color, heavily influences combat. The lifeline of a piece is considerably lengthened if it faces combat on a square close to (or the same as) its own color—the closer the match, the greater the advantage. Regardless of your piece's strength, you'll usually want to do battle on your own color.



Archon, from Electronic Arts.

BALANCE AND DIVERSITY

Another feature that distinguishes Archon from other games is its attention to balance and diversity. Examples of its diversity are that there are two ways to win and that seven spells are available to the sorceress and wizard pieces. An example of balance is that, although opposing pieces are different from each other in shape and capabilities, neither player has an advantage.

Archon gains vitality from its diversity and playability from its balance. Without diversity, a game becomes repetitive and boring. Without balance, one player has an unfair advantage, and the game suffers.

Unfortunately, Archon suffers from an imperfect balance between arcade and strategy skills. Although the game calls on both strategy and arcade skills, it seems to favor the player with more of the latter. I know—I seem to constantly lose to the same people who beat me in arcade games.

EVALUATION

Archon can be played against either the computer or a human opponent. (In this respect, it reminds me of two of my favorite multiplayer games, M.U.L.E. from Electronic Arts and Cytron Masters from Strategic Simulations.) The version reviewed here runs on any Atari home computer with 32K bytes of memory (an expanded Atari 400 or 600XL or a standard Atari 800, 800XL, or 1200XL). I wish the authors had made it a 48K-byte game and used the extra 16K to provide some variant games, differently skilled computer opponents, or some kind of handicapping. The computer opponent is unmercifully skillful, making the single-player game an exercise in good sportsmanship (how can you be a good sport when you lose to a computer?). Some Archon players claim they can consistently beat the computer—I'd be interested in knowing how.

Archon's authors, Anne Westfall, Jon Freeman (cofounder of Automated Simulations and author of the award-winning game Temple of Apshai), and Paul Reiche III, all of Freefall Associates, are to be thanked for their contribution to the gaming community. (They're said to be working on a sequel, Archon II.) Electronic Arts deserves praise as well for its superior game packaging and rule book, which make a good game even

more enjoyable, and for the exceptionally high standards that mark this and other Electronic Arts products.

Although Archon would be better if it had some game options and if it

placed less of an emphasis on arcade skill, it is still a great game: fun, yet not mindless; involved, yet not hard to learn; and rewarding and varied enough to be played again and again. ■



Photo 1: The chess-like strategy board of Archon. When two pieces meet on the same square, the action transfers to a combat battlefield (see photo 2).

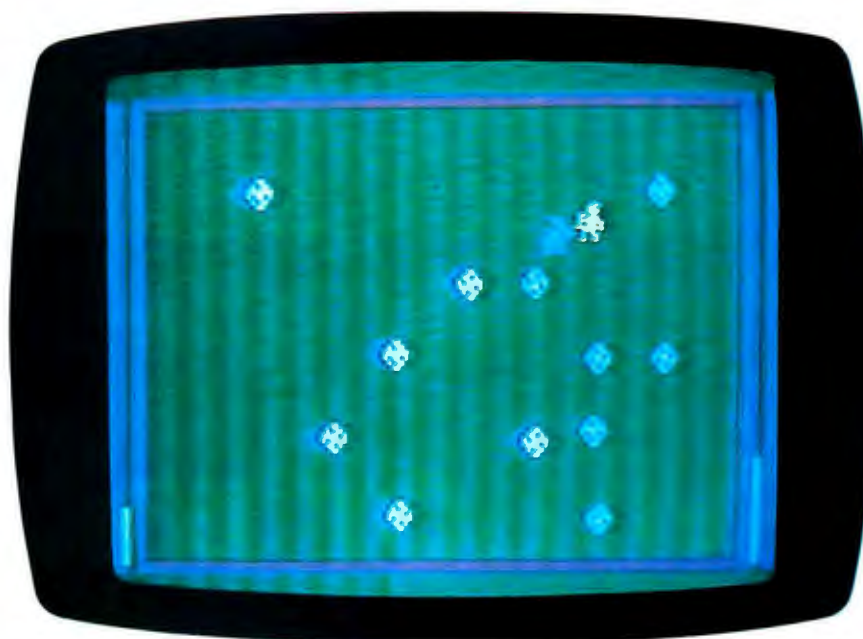


Photo 2: The Archon battlefield. Here, a dark goblin prepares to strike a light knight.

800 computing. We had to have something more than Atari could offer.

We seriously researched for about three months. The TI Pro won out for several reasons: best color graphics with standard equipment, a rich library of software available, and hardware options (8087) that we were told were available now. There are also about 20 pages of third-party hardware options available. The closest competitors were the Fujitsu Micro 16s and the DEC Rainbow. The deciding factor was a substantial discount from a retail outlet.

Well, there are a lot of things TI did not tell us. And whenever I try to find out anything, I get the feeling that no one is there.

A side note. When we were still shopping, we had some questions about the DEC Rainbow. I talked to a system engineer. He answered my immediate questions and sent me a technical manual. Gratis, even after I told him I was only shopping and did not know if I would buy.

I have gotten some support from the TI regional sales office, but supposedly I am to rely on the dealer for support. The salesperson is trying hard to satisfy us, but he just does not have all the answers.

Allow me to elaborate on one specific example. I understand that a programming language must be able to support the 8087 chip. But which specific programs do the job? Will the TI versions of the MSBASIC compiler or macro assembler do it? Microsoft doesn't know; it licenses the program to the OEM. Anyone at TI who will even talk to me does not know the answer. I am supposed to get that kind of technical support from my dealer. The poor salesperson knows how to run the demos, be friendly, and look up prices. The poor guy does not have the technical information and does not understand why I need to know it. Therefore, he does not persist with his sources of support information, and I, the end user, have to swallow another bitter pill.

I have had two TI TTY Communications programs, and neither one was usable. Both disks had so many unrecoverable read errors that the programs would not run, copy, or transfer to the hard disk. With regard to the prices being charged for software, the end user is entitled to an absolutely error free product.

In spite of all our negative comments, we are slugging it out in the trenches and enjoying the learning process. Let's see, after two days now we can copy disks, transfer the invisible system command into the unknown (there should be a warning on that command), read the TTY manual, and look at the WordPerfect program. (The pieces I ordered to construct the printer cable have not arrived yet.) Oh yeah, we can run diagnostics. Ahhhh, but the possibilities...

V. A. AND DEBBI WALSER
Staten Island, NY

We just got our TI Professional yesterday. It really looks well made, quite "professional." I hope we're not going to have the problems you did! Fortunately, I sit on a University of Texas Board of Visitors with a TI vice-president, so perhaps I'll be able to get some attention if it's needed.

More when I know more —Jerry

AN AUTHOR RESPONDS

Dear Jerry,

I just read your negative review of my game *Legionnaire* in the May issue, and I wanted to shoot back at you.

I'll begin by pointing out that the game was designed on and for the Atari 800, and one of my primary goals was to make full use of the special capabilities of that machine. Avalon-Hill decided to translate it onto the Apple against my advice, and I am not surprised that this Apple version generates such a negative review, the Apple simply can't equal the performance of the Atari. Moreover, I did not execute the translation myself, so I cannot vouch for the quality of the programming work.

Thus, I am conceding that many of your complaints about the game are absolutely correct. I will take you to task for several sins.

First, why are you evaluating a secondary product? In fact, why are you wasting your time playing games on a secondary games machine like the Apple? If you want to see the game, why not get an Atari and play the *real* game on a *real* games computer? Games on the Atari are much better than games on the Apple. Try *Legionnaire*, *Eastern Front* (1941), or *Excalibur* on the Atari. It would seem that you have no problem stuffing *Chaos Manor* with lots of expensive hardware; can you not find the space for a cheap little Atari? I realize that a lot more people have Apples than Ataris, but a lot more people play games on Ataris than on Apples.

I'll also fault you for calling *Legionnaire* "an arcade game masquerading as a strategy game." In the first place, the verb "masquerade" implies something about the intentions of the designer, and you don't know those intentions, so you misused the verb. In the second place, I designed the game as a strategy game with a real-time element. Fast reflexes are *not* essential to winning the game. Good strategy is essential to winning the game. So how can you justify calling it an arcade game?

I agree with all your objections about the poor human engineering of the Apple version. That game is so hard to play that it loses its appeal. It's a great example of how you can ruin a good Atari game by translating it to the Apple.

CHRIS CRAWFORD
San Jose, CA

Well, we have an Atari, but I can only review what I was sent—which was the Apple version. Maybe you can talk Avalon-Hill into sending it for the Atari?

*While I have the designer on line—why the devil did you use only part of the screen? One of the most annoying "features" of *Legionnaire* is having to move the map window around.*

As to the rest, "masquerade" referred to the game, not to the designer. It sure felt like an arcade game to me! And you can say that fast reflexes aren't needed, but I thought so: if there'd been a way to slow it down, I would have done so. Perhaps I'll like the Atari version; certainly I thought I would like the game right up to the point when I began playing it.—Jerry

TECHNICAL-SUPPORT IDEAS

Dear Jerry,

I have a few solutions to the technical-support dilemma to suggest.

1. Supply with each software package the names and phone numbers of the last few local people to buy it. You can call them if you need pointers. This could start some new friendships and could also lead to some headaches for users who don't like to get calls.

2. Supply with each package 10 chits for general answers and 4 for technical answers. These could be in the form of randomly selected large numbers. When you call (toll-free number, of course), you would have to give a valid number or they would hang up. If the reason for the call turns out to be their error (software doesn't match advertisement or documentation), you get a replacement chit. This would supply an incentive to keep the documentation up to date. I suppose they might offer chits for sale, too.

3. Give you access to an expert system primed with answers to the most common questions. If it can't answer a question, it forwards it to a human who subsequently adds the answer to the system. This way, a computer handles the boring part of the job. Eventually, you could hope to get an initial expert system (on an optical disk?) with the software.

JAMES R. VAN ZANDT
Nashua, NH

Hah. Your first solution would, I suspect, lead to mayhem. Of course, computer clubs do provide something like that service.

I doubt that software, at least for machines available to most developers, is up to 3.

I like 2. Maybe somebody will adopt the idea.—Jerry

PUBLISHING DELAYS

Dear Jerry,

I enjoy your columns very much. In fact, they're the first thing I read when a new *BYTE* arrives. However, it's a shame that your column is nearly six months old when it finally gets printed. Can you explain why there's such an outrageous transport lag in the publishing system?

TIM PENNER
Wichita, KS

Consider: I send in an article. A technical editor has a go at it. It then goes to copy editing. Then typeset. Then proofed. Galleys are sent back to me. My corrections are sent back and inserted, and another typeset galley is output. Now the whole magazine has to be pasted up, proofread, and sent to the printer.

Then it's printed and put into the mail. While it's supposed to go out pretty fast, sometimes the letter carriers balk at hauling more than three or four copies at a time and thus spread out distribution.

Wish I had cheerier news, but I don't.—Jerry
(continued)

Turbo Pascal review. First, the ELSE clause in the CASE statement need not be preceded by a semicolon, and it can contain a BEGIN . . . END block. The example in the Turbo manual could just as well have read:

```
case Year of
  Min..1939: begin
    Time := PreWorldWar2;
    write('The world at peace');
  end;
  1946..max: begin
    Time := PostWorldWar2;
    write('Building new world');
  end
else begin
  Time := WorldWar2;
  writeln('We are at war');
end; {else}
end; {case}
```

The fault is not in the compiler (unless tolerance is a fault), but in the documentation, which fails to point out that the more Pascal-like syntax is available. Probably many users have noticed that when they are not looking at the manual they substitute the more sensible construction without much thought.

Also, Mr. Wadlow says that Turbo's typed constant produces a "read only" variable. If he means what I think he means, he is wrong. The manual calls it an "initialized variable"; you *can* assign values to it. You can use typed constants not only to save space but also to avoid the necessity of declaring variables in one spot and assigning initial values to them in another; then you can assign new values to them at run time.

PETER S. BAKER
Atlanta, GA

We use Pascal for program development. We have found that we can move our applications to many different systems. News of new Pascal compilers is particularly important to us, so your review of Turbo Pascal was most welcome. Unfortunately, Mr. Wadlow missed using the most important tools for evaluating a Pascal implementation and thus presented an incomplete and inaccurate review.

The British Standards Institution (with the American National Standards Institute's support) has developed sophisticated, easy-to-use tools for testing Pascal systems. These include the Pascal Validation Suite (734 test programs) and the Standard Pascal Model Implementation (a complete and valid compiler and interpreter). All serious developers of Pascal systems use these tools.

We would be glad to provide any reader with detailed information on BSI's Pascal compiler validation services. Send a stamped, self-addressed envelope to the address below.

RICHARD J. CICHELLI
Software Consulting Services
Technology Center 125
Lehigh University
Bethlehem, PA 18015

In his Turbo Pascal review, Tom Wadlow is right about the violation of Pascal grammar in the CASE statement default (ELSE without a BEGIN . . . END for multiple line block—the other clauses certainly require this).

On the other hand, he is wrong about typed constants. These are in-line static variables, similar to those in C (they can be used as local variables to carry values between subsequent calls of a procedure or function, and they have the advantage of maintaining locality of the variable). Assignments to these "constants" is possible, and the manual confirms this. Calling these variables constants is a far greater violation of the spirit of Pascal than the CASE . . . ELSE grammatical complaint; a constant should, after all, be constant. This style of variables is useful, but it should be provided as a class of variable.

The author contends that Turbo Pascal has no built-in FLOAT function. In fact, INT will accept an integer value and convert it to floating point (quite unlike BASIC where INT returns an integer value). The documentation on the INT function mentions that it accepts both integer and real values and returns a real value. I don't have a copy of Jensen and Wirth to check this against, so it might be quite proper although it feels incorrect.

The new version of Turbo Pascal (2.0) includes standard heap management (DISPOSE, NEW) and simple overlays. The author is not at fault here, but I feel this should be mentioned. A more serious omission occurs when the reviewer fails to emphasize the degree of upward compatibility between the 8- and 16-bit versions.

I have noticed one obscure problem in Turbo Pascal when I want to compile to disk and specify the starting address for the compiler code. The .COM file generated includes all the unused memory, so even a short program that starts in high memory can become huge. My only other complaint is that the Turbo menu does not provide any method for eliminating unwanted files.

As a final note of interest, Turbo Pascal

lets the programmer change the value of a loop index variable, but this does not affect the number of times that the loop executes (apparently Turbo uses an anonymous loop index to count repetitions and performs operations on the named index variable separately).

ALLAN R. MCCOY
Lafayette, IN

Regarding your review of Turbo Pascal and your reviews of compilers generally, I would like to make a request. Please include in the review the precision of mathematical calculation that the compiler supports in its library functions and how extensive those library functions are for mathematical purposes. Also, it would be nice to see more in-depth review of the characteristics of the I/O library.

If you don't know how precise the mathematical capability is or the idiosyncrasies of the I/O, you might find that while adequate and inexpensive for general purposes, the compiler cannot satisfactorily perform specific applications—perhaps the reason you are buying the program.

DONALD B. SLAUGHTER
Seattle, WA

ELUSIVE 80187

.....
You recently carried a product description of the Tandy Model 2000 MS-DOS microcomputer (March, page 306). In this article, Rich Malloy referred to a new product called the Intel "80187 floating-point numeric processor." We have received several inquiries about this chip.

In fact, our current production part, the 8087 Numeric Data Coprocessor, works with the entire 8086 family of microprocessors: the 8086, 8088, 80186, and 80188.

To use the 8087 coprocessor with an 80186 or 80188, the designer would use the 82188 Integrated Bus Controller (IBC). Literature on the IBC is available through Intel's Literature Department, 3065 Bowers Ave., Santa Clara, CA 95051, order #231051-001.

LYNN MCLEOD
Intel Corporation
Santa Clara, CA

ATARI IN BUSINESS

.....
We would like to provide an update on our review of the ATR8000 disk interface for the Atari 800 (December 1983, page 329).

In January of 1984 (well after we wrote the article), new regulations from the FCC

(continued)

Get an "A" on your Paper.

It's one o'clock in the morning. Your term paper on the American Revolution is due at 8 a.m. Where was the misnamed Battle of Bunker Hill *really* fought? It could be the difference between an "A" and a "B".

Now there's smart software™ for the Macintosh™ computer.

With Straight Talk, the smart software from Dow Jones, you can use an electronic encyclopedia to find the historical fact you need. Even if it's the fact that on June 17, 1776 the Battle of Bunker Hill was fought on Breed's Hill.



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Dow Jones Straight Talk™

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went into effect concerning RF (radio frequency) emissions from home computing equipment such as the ATR8000. Because of the many cables that act as transmitting antennas when hooked up to the ATR8000, it could not pass the requirements for a home computer but could pass the requirements for a business computer. Hence the ATR8000 is now being sold as a business computer with 64K bytes of memory, and the manufacturer is not allowed to manufacture and sell the home version that has only 16K bytes of memory. The manufacturer can, however, sell units already manufactured.

Many dealers still stock the 16K version, particularly mail-order houses.

DAVID AND SANDY SMALL
Austin, TX

MODULA-2

On behalf of Volition Systems, I'd like to thank BYTE for publishing the review of our Modula-2 (June, page 353). Eric Eldred deserves credit for his thoroughness in testing the software; however, many of the problems he encountered were due to his not reading the documentation.

The reviewer said that there is no overall summary of the manual. In the seven-page introduction is a section (on page 4) titled "How to Use This Manual." It explains what order to read the remaining sections in to avoid the problems he encountered.

If Mr. Eldred had read the installation notes, he would not have had to ruin the contents of his Corvus hard disk and then phone Volition Systems to find out what happened. The installation notes for Modula-2 version 0.3K specifically state that it does not work with the Corvus hard disk.

The reviewer said he had to make up his own list of intermodule dependencies. The implementation guide already contains such a list on page 23.

Mr. Eldred claims that Niklaus Wirth's book (*Programming in Modula-2*) states that the module LineDrawing should be included in every Modula-2 implementation. This is not true; Wirth makes it clear (on page 113) that this module is only a suggestion—not a standard.

Other than these problems, the reviewer was generally on the mark. The BYTE benchmark results were apparently switched; the execution time with range checking off is 322 seconds, not 375. Also, Volition Systems' Modula-2 programs are portable at the source level but not at the code level.

The long integer problem described in

Conducted by Steve Ciarcia

CORONA COMPATIBILITY

Dear Steve,

I've had my Corona PC for about a year now, and for the first time I've run into an incompatibility with the IBM PC. The problem is that the IBM PC has an extra open socket built into it to add a ROM or EPROM, and the Corona doesn't. A few programs on the market make use of this socket, including a genetics program I am interested in. Is there a fairly simple way to add an extra ROM chip?

Another problem is that my BIOS is written on a 28-pin 2764, while the chip for the genetics program is on a 24-pin 2732A. How can I use the 2732 in my Corona, and what is the difference between a 2732 and 2732A anyway?

Yet another problem is the Corona's incompatibility with IBM graphics. To get graphics on the IBM, you must buy a graphics color card, which uses memory locations B800 to BC00 hexadecimal. On the Corona, different RAM locations are used for graphics. Is there a way to modify programs that need the color card (e.g., Flight Simulator) so that they will work on the Corona? It may not be that difficult because there is a graphics driver by HST, which if loaded before Lotus 1-2-3, enables 1-2-3 to draw graphs perfectly on my screen.

RICHARD BERMAN
King of Prussia, PA

You should be able to add a ROM to the Corona by installing it on an expansion board with the proper interfacing circuitry. This could be built on a PC prototyping board, such as those produced by Vector Electronic Co., POB 4336, 12460 Gladstone Ave., Sylmar, CA 91342, (818) 365-9661. Since all 20 address lines are available in the I/O channel (expansion slots), you can set up the addressing as required for the ROMs with your genetics program. There could be interference between the Corona's BIOS ROM and the add-on ROM. IBM uses 40K bytes out of the 48K bytes of reserved ROM space, and I suspect that the Corona uses the same space to preserve compatibility with IBM.

The 2732s are programmed at +25 V,

while the 2732As require only 21 V.

A possibility exists that the HST graphics-driver program you mention may allow you to run the new Microsoft Flight Simulator on your Corona but not the original version. The new version can be loaded from DOS with the command FS, so a driver can be loaded ahead of the program. The original version could be loaded only by rebooting, which of course wipes out the graphics driver. See your dealer for a demonstration before you buy because there may be other incompatibilities not fixed by the HST driver.—Steve

SOURCE BOOK NEEDED

Dear Steve,

As a computer counselor, I help clients with hardware and software purchases, checking sources and buffering clients from high-pressure salespeople. Since I am not affiliated with any computer manufacturer or outlet, I do not limit my clients to the selections of a particular store. However, this lack of affiliation means that I do not receive promotional materials, which limits my effectiveness. Can you recommend any source book that lists various computer manufacturers and gives at least minimal specifications on their products?

PATRICIA SELK
Stafford, VA

Many sources of information of the type you need are available. First, most computer magazines, including BYTE, publish reviews of microcomputers, peripherals, and accessories. These are a good source of unbiased information.

Second, you can get promotional information from manufacturers by writing to them on your letterhead, explaining your needs. Their addresses are available in ads in BYTE and other magazines and are frequently published in buyers guides and directories available at most computer stores and many bookstores.

A third source is companies that specialize in publishing survey reports on this type of equipment. One of these is Data-pro Research Corporation, 1805 Under-

wood Blvd., Delran, NJ 08075, (800) 257-9406.—Steve

DRIVE-HEAD PROBLEM

Dear Steve,

I bought an Atari 800 and two Atari 810 disk drives three years ago. Some time ago, one of the drives began to have problems. Before realizing that it was only a burned-out IC, I measured the head's resistance with a digital tester. Since then, the drive seems to be able to write but does not read. I think I've magnetized the head. I tried to demagnetize it with various methods (including the use of a commercial head demagnetizer for cassette recorders), but I haven't had any success. If you think I must replace the head, could you tell me where I could buy it?

ODINO CIAI
Buenos Aires, Argentina

Digital testers normally do not supply enough current to damage a disk-drive read/write head. You did not say whether you could write to a disk and read it from the other drive. It is possible that the alignment of the head was disturbed when you were making your tests. Try some cross-checks to see if that is the case. Also, check the obvious things, such as dirt on the head and a worn head-load pad. The head-load pad is a little felt pad that keeps the disk in contact with the head. If it is worn, data may not be properly read or written. Check the continuity of the read head with an ohmmeter or your digital tester. If the head coil is open, see if there is a mechanical break in the wiring.

If you are convinced that the head is defective, a replacement can be obtained from Micro Peripherals Inc., 9754 Deering Ave., Chatsworth, CA 91311, (213) 709-4202.—Steve

SHARING FILES

Dear Steve,

We have several Eagle PCs in our analytical laboratory, all of which use two pieces of software: pfs:File and Lotus

(continued)

Two New Color Computers from Atari

Atari has two new color computer lines: the 68000-based ST and the 800-compatible XE.

The ST comes with a two-button mouse and Digital Research's GEM, a user interface that has pull-down menus, icons, and overlapping windows. GEM is embedded in 192K bytes of ROM along with TOS (Tramiel operating system, named for Atari president Jack Tramiel) and a game. For more on GEM, see page 39 of the December 1984 BYTE.

The ST, which can handle television, composite color, monochrome, and RGB outputs, produces graphic resolutions ranging from 640 by 400 pixels (monochrome) to 320 by 200 pixels (16-color mode). Its 84-key keyboard is augmented with a numeric keypad and 10 function keys. ROM cartridge, RS-232C serial, Centronics parallel, and floppy- and hard-disk drive interfaces are supplied. Also, the ST carries a three-voice sound chip and a MIDI port for linking it to musical instruments and synthesizers.

The 128K-byte Model 130ST will sell for approximately \$400, and the 512K-byte Model 520ST will be about \$600. Shipments are to begin shortly. Atari plans to offer a 10-megabyte ST hard-disk drive for about \$600. Both a composite color monitor and a 3½-inch disk drive will be priced in the \$150 range.

Four versions of the Atari XE computer will soon go on sale. The basic XE comprises a 57-key keyboard,



The Atari 130ST comes with GEM and color.

five special-function keys, a ROM cartridge slot, BASIC in ROM, and four-voice sound. Graphic resolution is 320 by 192 pixels. Atari's 11 graphics modes and Player Missile Graphics are provided.

The Model 65XE, with 64K bytes of RAM, will cost \$120. The \$400 portable 65XEP comes with a built-in

floppy-disk drive and a 5-inch monochrome monitor. The 128K-byte 130XE will be under \$200. The 65XEM will be outfitted with an eight-voice music synthesizer chip. Its pricing had not been finalized at press time.

Contact Atari Corp., 1265 Borregas Ave., Sunnyvale, CA 94086, (408) 745-5224. Inquiry **600**.

Integrated Software for Ataris

Infinity, an integrated software package for the Atari's 800XL and XE series, is made up of word-processing, spreadsheet, file-management, graphics, and communications functions. It uses pull-down menus, icons, split screens, and context-sensitive help. Files can be imported or exported in any of nine formats, one of which lets you transfer data over a local-area network or through an RS-232C port.

Developed by Matrix/Systems Group Corporation, Infinity will be distributed for the 800XL and XE by Atari. Versions are also planned for Atari's ST series and other systems using Digital Research's GEM operating environment.

Contact Atari Corp., 1265 Borregas Ave., Sunnyvale, CA 94086, (408) 745-5224. Inquiry **601**.

Sharp Computer Has Four-Color Plotter

Sharp's PC-2500 portable computer comes with a four-pen color plotter that draws graphs or text on paper up to 4½ inches wide. The PC-2500 has 5K bytes of battery-backed memory and a 4-line by 24-character LCD. Address/phone-directory software and BASIC are incorporated in ROM.

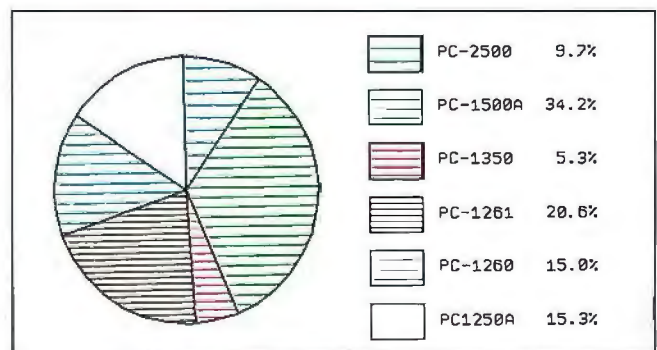
This notebook computer has a low-power serial port so that it can interface to other Sharp peripherals; an optional adapter can convert this signal to an RS-232C serial interface. An 8K- or 16K-byte battery-backed RAM-card option expands

the PC-2500's data storage.

The 3-pound PC-2500 will sell for less than \$450. Contact Sharp Electronics Corp.,

10 Sharp Plaza, Paramus, NJ 07652, (201) 265-5600. Inquiry **602**.

(continued)



Sample output produced with the PC-2500's color plotter.

Conducted by Steve Ciarcia

SEARCH AND REPLACE

Dear Steve,

In the December 1983 BYTE, Donald Derksen requested advice in searching sermons for specific text.

I am not certain that a program exists to do a word search over anything near 100 megabytes. I have several word processors, and each creates a temporary file, almost as long as the original file, when I try to bring it up. A 150K-byte sermon in this case will require a 300K-byte disk to access. To get WordStar to bring up a 150K-byte file, I go to lunch while it gets its stuff in order. If I accidentally ask for a global search, I go out and buy a case of beer.

If WordStar could handle a file in the megabyte range on a hard disk, presumably the best Mr. Derksen could get would be less than 50 megabytes on a 100-megabyte disk. Of course, since his workday comes only once a week, the system could grind away doing a global search.

I bought my computer for the sole purpose of working my family tree, which is 200K bytes. Can you recommend any simple "find and replace" word processors for this job?

MARVIN KONOPIK
APO San Francisco, CA

I compared the times to search and replace through a 120K-byte ASCII file produced with Volkswriter Deluxe using three different programs on the IBM PC. These were one-word "find and replace" operations, and the word occurred 63 times in the file. The file contained 2900 lines of text.

WordStar version 3.3, in the nondocument mode, using the ^QQ~QA N command to repeat the find/replace without stopping, took 221 seconds. Using the ^QA NG to perform the same function took 206 seconds.

Volkswriter Deluxe can handle somewhat larger files, since it puts the temporary file on a different disk from the main file. Volkswriter took 112 seconds to perform the same operation on the same file.

The real speed demon of the three is Edlin, the line editor that comes with the

IBM PC as one of the utilities included with PC-DOS. This program could handle only 1200 to 1300 lines at a time but performed the find/replace operation in about 10 seconds on each of three 1000-line segments. The whole operation of loading the file, replacing the strings, and saving the edited file could be done in about the time it takes WordStar or Volkswriter to save the edited file.

Edlin file size is limited by its requirement to make a backup on the same disk as the original file. It may handle larger files than WordStar but not 200K bytes as a single file on a 320K- or 360K-byte floppy disk.

The most efficient method of finding the lines containing a string is the DOS 2.1 Find function. This function found and returned the line numbers and text of all 63 occurrences of the search string in 26 seconds, including time to read the Find program into memory. Unfortunately, no replace option is available.

Both WordStar and Volkswriter speeds were limited by the disk-access speed, since both programs keep only part of the file in memory and transfer the overflow to a temporary disk file. Volkswriter's higher speed appears to be due to using a slightly more efficient method of using the temporary "spill file."—Steve

ATARI AND COMMODORE

Dear Steve,

In Yugoslavia it is hard to obtain information about Atari and Commodore computers. I shall be very grateful if you could give me a few names and addresses of Atari owners in your country so I could exchange information.

I am also interested in names and addresses of firms selling software.

ROBERT DEVCIC
Zagreb, Yugoslavia

The Blue Book for the Atari Computer and The Blue Book for the Commodore Computer are two "where-to-find-it" books covering software, hardware, and accessories. These two books are available for \$17.95 each from H&E Computers Inc., 50 North Pascack Rd., Spring Valley, NY 10977.

The Toronto PET Users Group offers access to hundreds of public-domain programs and a monthly club magazine for the Commodore 64. Membership for 12 months is \$30 overseas and \$20 in the U.S. and Canada. A program and information catalog is available for \$1 from Toronto PET Users Group, 1912A Avenue Rd., Suite 1, Toronto, Ontario M5M 4R1, Canada.

A number of magazines publish programs for the Commodore 64 and Atari computers. They are mostly hobbyist magazines with emphasis on entertainment and programming techniques. Seeing how someone else did it can be very helpful to one learning about computers, and, of course, contributions are welcome. Some of these magazines include

Analog
565 Main St.
Worcester, MA 01611

Compute! and Compute!'s Gazette
POB 5406
Greensboro, NC 27403

Run
Subscription Dept.
POB 954
Farmingdale, NY 11737

—Steve

ACOUSTIC MODEMS

Dear Steve,

I am the owner of an Atari 600XL home computer with a 1027 printer and the 410 recorder. Is there a way to use an acoustic modem without the aid of the Atari interface box?

Also, is there a way to erase programs stored on tape?

JON PAUL PARKER
Kansas City, MO

Most acoustic modems require a serial interface, such as that provided by the Atari 850. For disk users, the \$49.95 R-Verter from Advanced Interface Devices Inc., POB 2188, Melbourne, FL 32902, can be used instead of the Atari 850 to connect most modems and RS-232C serial devices.

(continued)



Atari 800XL

A new look for an old friend

BY JON EDWARDS

It is uncertain where Atari's future lies, but Jack Tramiel, former Commodore chief and now the head of Atari, has announced his intention to introduce a new range of computers, including the new XEs and a GEM-based 68000 computer. The future of the XL line is unclear, but the quality of the old machine, its current low price, and the enormous amount of available software certainly make it an attractive purchase.

Atari computers have reputations as game machines, an image reinforced by their excellent graphics and sound capabilities. The 800XL is a superb game computer, with the addition of four more graphics modes obtainable directly from BASIC. The total number of modes is now 16, from a 24- by 40-pixel text mode to 192 by 320 pixels for graphics; most graphics modes also have options for 40-column text windows (see table 1 for a summary of available graphics modes).

You can still place up to 256 colors at once on the screen, alter the display list for customized graphics, change all or part of the character set, define up to five sprites (called players and missiles), produce harmonies on four sound channels, use vertical blank interrupts, call on the real-time clock, and add page flipping and fine and coarse scrolling (see photo 1 for a sample screen display). Of course, these capabilities are useful for more than games.

RESTYLING

The 800XL is brown and beige, with silver function keys. It measures 15 by 8½ by 2 inches and, although it weighs 5 pounds 5 ounces, it has a solid, substantial feel. The XL has a revised Antic chip for the screen display, which offers improved color saturation.

The biggest change, however, is a parallel bus with a 50-pin connector; the bus gives direct access to the 6502 16-bit address and 8-bit data buses. The only presently available devices to take advantage of the parallel bus are 64K-byte memory expan-

sions for the Atari 600XL. Potentially available are similar expansions to 128K bytes for the 800XL, as well as an 80-column board and real-time system control. For more extensive expansion, hackers have the ATR8000 (see "The ATR8000" by Dave Small and Sandy Small, December 1983 BYTE, page 329), which lets the Atari run CP/M-80, CP/M-86, and MS-DOS.

The built-in, 62-key keyboard has a comfortable feel (see photo 2). Features include automatic key repeat, inverse video, and specifically designated keys to move the cursor, insert, delete, clear and set tabs, and clear the screen. A new Help key joins the Start, Select, and Option function keys. The Reset key has a hard spring to minimize accidents. More important, the Reset key provides a true hardware reset, not the pseudo-reset that did not always resurrect the system from crashes.

The inverse-video key is now better placed on the outside rather than the inside of the right Shift key. Only the higher-than-normal position of the Return key remains a problem. You can even eliminate the keyboard click since the sound is routed through the television or monitor speaker and not through the internal speaker. The character graphics available in conjunction with the Control key are not marked on the keys, but stick-on labels are available. A wide range of peripherals, including a numeric keypad, four different graphics tablets, light pens, joysticks, paddles, and trackballs are also available.

Unlike the Atari 800, the 800XL has a single cartridge slot, electrically identical to those in the 400/800. Atari never marketed cartridges for the second cartridge slot on the 800, and a single slot on the XL apparently lessens the game-computer image. Only a few products, including programming aids and a screen-dump utility, used the second cartridge slot, but you might miss its potential. Perhaps for similar reasons, Atari provided only two joystick

(continued)

Jon Edwards is a technical editor for
BYTE. He can be contacted at
POB 372, Hancock, NH 03449.

ports, a policy that will undoubtedly disappoint aficionados of four-player games.

Other changes include the addition of memory, keyboard, and sound tests that use about 2K bytes of ROM (read-only memory) but add very little in the way of diagnostics. The

audio-visual test doesn't identify which colors you ought to see, and the keyboard displayed on screen closely resembles the one on the 1200XL and not the 800XL. A new foreign-character set takes up another 1K bytes of memory. Many users probably would prefer full English er-

ror messages in BASIC. The POKEY (sound generator and controller ports) and the PIA (peripheral interface adapter) remain unchanged, save that the second PIA interface, used on the 800 to monitor the third and fourth joystick ports, enables and disables a resident BASIC (starting at address A000 hexadecimal) on the 800XL. To boot programs that do not require BASIC, press the Option key when turning on the computer.

BASIC

The built-in BASIC, revision B, corrects problems with the original BASIC cartridge, especially the annoying computer lock-ups during heavy editing, but it unfortunately introduces new problems. Repeatedly saving a program under development uses up available memory. Atari includes instructions to recover the unused variable name and program space, which accumulates during successive save/load operations. A better solution is to buy revision C for \$15 from Atari Customer Service. Even bug-free, the BASIC could be improved.

However, a number of important features make Atari BASIC attractive to beginners and experienced users. Many will appreciate automatic syntax checking, full on-screen editing, access to sound and graphics without learning specific memory locations, allowance for long variable names, an option in the `USR` statement to pass several variables to machine-language subroutines, and well-spaced readable code. String arrays can be simulated but not directly implemented. Unfortunately, error messages appear only as cryptic numbers; users should keep their manuals handy. (The original designers of Atari BASIC, Optimized System Software [OSS], have released BASIC XL, an improved BASIC for serious users; see the text box "BASIC XL," page 271.)

Though advertised as having 64K bytes of RAM (random-access read/write memory), the 800XL actually has 20 bytes less free RAM in BASIC. The additional 16K bytes added to the computer's memory is bank-selected

(continued)

Table 1: Summary of text and graphics modes directly available in Atari BASIC (reproduced from Atari BASIC Reference Guide, page 9).

Screen Format

Graphics Mode	Mode Type	Columns	Rows—Split Screen	Rows—Full Screen	Number of Colors	RAM Required (bytes)	
						Split	Full
0	Text	40	—	24	1.5		992
1	Text	20	20	24	5	674	672
2	Text	20	10	12	5	424	420
3	Graphics	40	20	24	4	434	432
4	Graphics	80	40	48	2	694	696
5	Graphics	80	40	48	4	1174	1176
6	Graphics	160	80	96	2	2174	2184
7	Graphics	160	80	96	4	4190	4200
8	Graphics	320	160	192	5	8112	8138
9	Graphics	80	—	192	1.5		8138
10	Graphics	80	—	192	9		8138
11	Graphics	80	—	192	16		8138
12	Graphics	40	20	24	5	1154	1152
13	Graphics	40	10	12	5	664	660
14	Graphics	160	160	192	2	4270	4296
15	Graphics	160	160	192	4	8112	8138

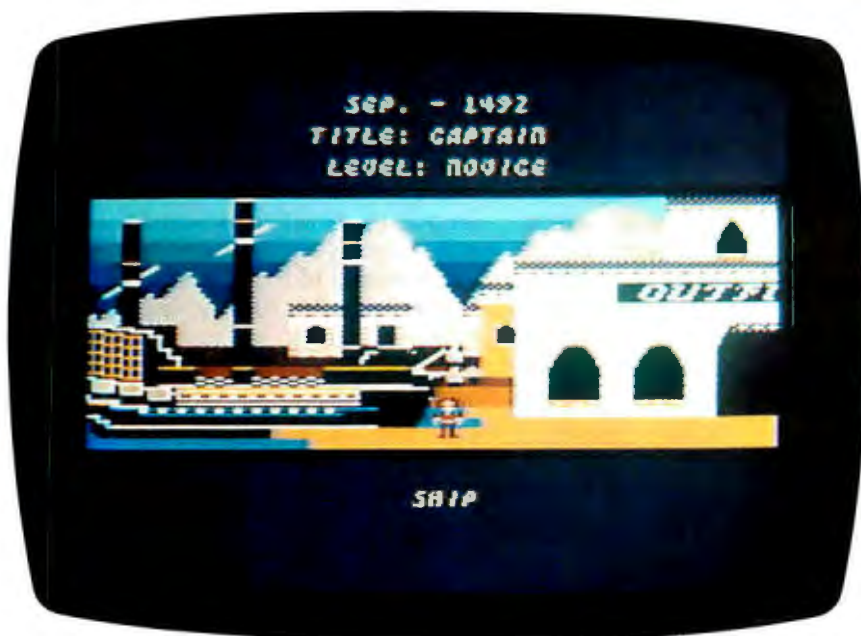


Photo 1: Screen display from Electronic Arts' *Murder on the Zinderneuf*. The Atari 800XL allows customized graphics displays and character sets.

AT A GLANCE

Name

Atari 800XL

Manufacturer

Atari Corp.
1312 Crossman Ave.
POB 61657
Sunnyvale, CA 94086
(408) 745-2109

Components

Memory:

64K bytes bank-selected

Processor:

Modified 6502C, 1.79 MHz

Special integrated circuits:

GTIA (graphics display),
POKEY (sound generator and
controller ports), and Antic
(screen control)

Keyboard:

Full-stroke design; 62 keys,
including Start, Option, Select,
and Help keys; international
character set; 29 graphics
characters

Display:

TV or video monitor output,
16 text/graphics modes, 256
colors displayable at once,
maximum 320- by 192-pixel
resolution, 40 by 24 maximum
text display

Sound:

Four independent sound
channels, 3½-octave range

I/O interfaces:

Cartridge slot, serial I/O for
disk drives, external parallel
bus for future peripherals

Software

Resident Atari BASIC, DOS 3.0
supplied with the Atari 1050
disk drive

Options

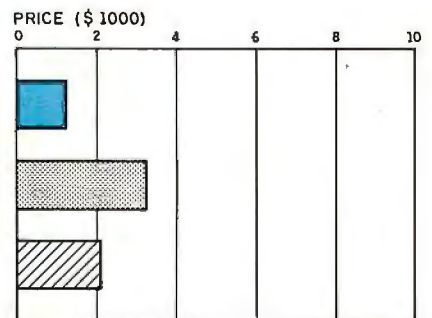
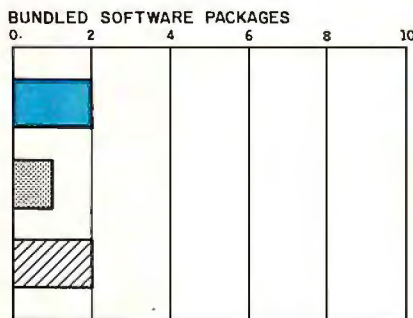
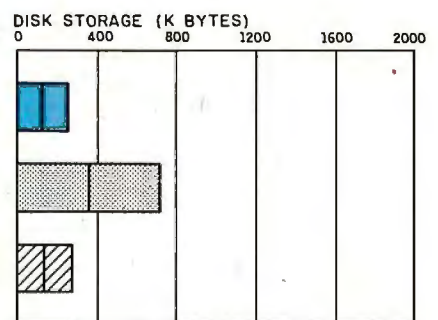
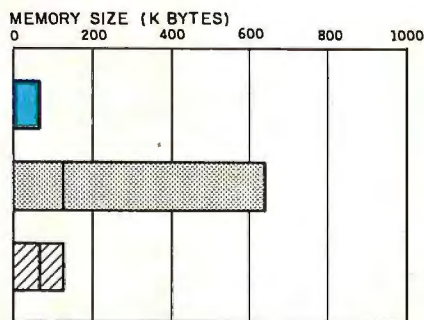
Wide variety of peripherals,
including disk drives,
interfaces with parallel and
serial ports, printers, graphics
pads, light pens, joysticks.
CP/M and MS-DOS capability
with the ATR8000.

Documentation

Short BASIC and owners
guides

Price

64K bytes, two disk drives,
monitor, parallel and serial
ports \$1240



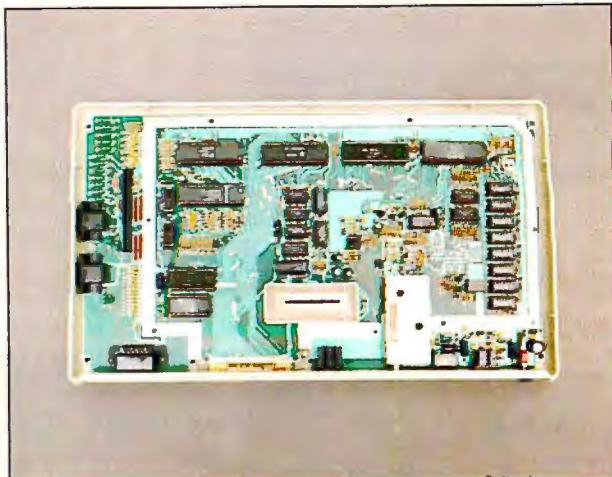
■ ATARI 800XL ■ IBM PC ■ APPLE II E

The Memory Size graph shows the standard and optional memory for the computers under comparison. The Disk Storage graph shows the capacity of one and two floppy-disk drives for each system. The Bundled Software Packages graph shows the software packages included

with each system. The Price graph shows the list price of a system with two disk drives, a monochrome monitor, graphics and color-display capability, a printer port and a serial port, and the standard operating system and BASIC interpreter for each system.

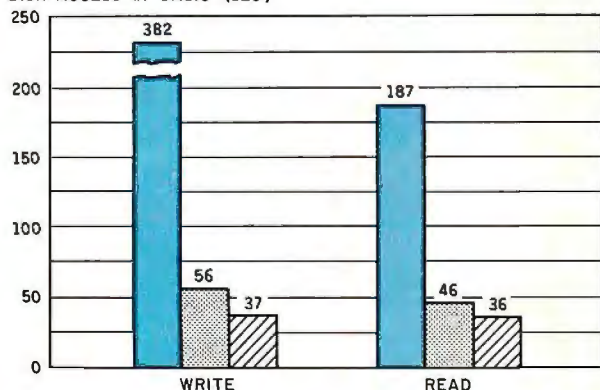


The back panel of the 800XL. Note the parallel bus, the XL's most important new feature.

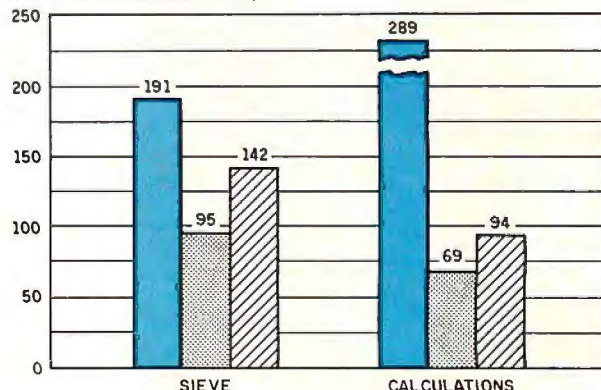


Inside the XL. From lower left, the single board contains the Antic chip, GTIA, 6502C, PIA, and then up toward POKEY (on the right side) the 16K-byte OS ROM, and the 8K-byte BASIC.

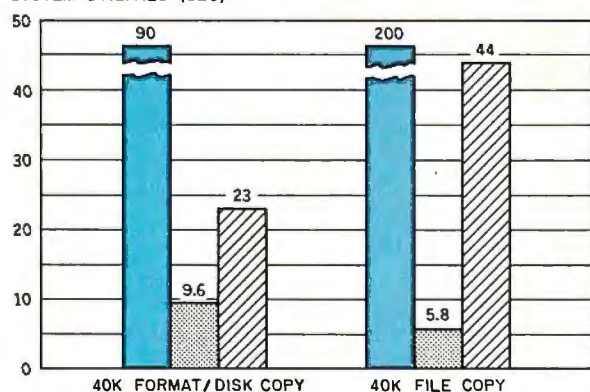
DISK ACCESS IN BASIC (SEC)



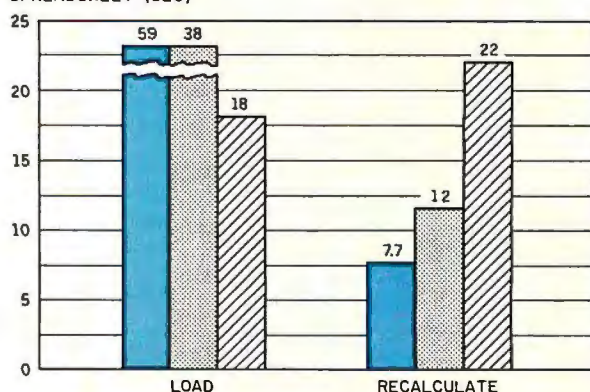
BASIC PERFORMANCE (SEC)



SYSTEM UTILITIES (SEC)



SPREADSHEET (SEC)



■ ATARI 800XL ■ IBM PC ▨ APPLE II E

The graphs for Disk Access in BASIC show how long it takes to write and to read a 64K-byte sequential text file to a floppy disk. (For program listings see "The Chameleon Plus" by Rich Krajewski, June 1984 BYTE, page 327, and Fixes and Updates, October 1984, page 33.) A modified Sieve graph shows how long it takes to calculate 1000 primes off the Sieve of Eratosthenes prime-number benchmark. The Calculations graph shows how long it takes to do 10,000 multiplication and division operations using single-precision numbers.

The System Utilities graphs show how long it takes to format and copy a disk (adjusted time for 40K bytes of disk data) and to transfer a 40K-byte file. The Spreadsheet graphs show how long it takes to load and recalculate a 25- by 25-cell spreadsheet where each cell equals 1.001 times the cell to its left. The Apple used Microsoft Multiplan. The Atari and IBM used VisiCalc. The tests for the Atari used DOS 2.0 with two Atari 810 disk drives. Tests for the Apple were done with ProDOS. The IBM PC was tested with PC-DOS 2.0.

and available only to machine-language programs and subroutines, including those called by BASIC. A new option that lets developers and users switch operating systems involves new pointers that use up the additional 20 bytes; to date, only Atari provides software that installs a different operating system. This translator disk, released well after the machine's introduction, lets users run third-party software written for the Atari 800 by installing that operating system in the Atari 800XL.

COMPATIBILITY

In creating the 800XL operating system (OS), Atari preserved the entry points to the principle ROM routines. Unfortunately, in a quest for copy protection and additional speed, many third-party software houses bypassed these entry points. As a result, a substantial amount of non-Atari software cannot function on the 800XL. Only two Atari products, States and Capitals and Graph IT, have trouble on the XL.

The translator disk, available from Atari Customer Service and the many users groups for a small fee, does an excellent job of providing compatibility with older software. When booted, the translator disk switches off the resident ROM and loads a choice of Atari 800 operating systems into lower RAM. One side of the translator disk provides OS version A, installed in pre-1982 Atari computers; the other side contains version B. It also demonstrates on screen the fabulous graphics capabilities of the new GTIA graphics modes.

The translator should run all the third-party software using what Atari originally called "illegal" entry points. Two software retailers reported no consistent returns of products from 800XL owners, and I have had no trouble loading any software. Cassette owners should know that Atari does not provide a cassette version of the translator. Disk and cassette versions currently advertised in *Analog* and *Antic* magazines claim to provide a more comprehensive fix than Atari's.

(continued)

BASIC XL

Optimized Systems Software Inc. (OSS), the creator of Atari BASIC, markets BASIC XL, an improved cartridge BASIC. The 16K-byte cartridge has four 4K-byte blocks, only one of which is always active. The other three are bank-selected depending on the function required. The result is much more power and flexibility than the original 8K-byte BASIC.

BASIC XL fully implements string arrays, with the addition of LEFT\$, MID\$, and RIGHT\$, but preserves Atari BASIC strings as an option. OSS has replaced the numeric error messages with full text. Other features include block deletes, automatic renumbering, inputting with prompts, DOS commands direct from BASIC, built-in trace features, automatic line numbering, and an easier tab function.

A new Print Using command gives much more versatile outputting to the screen or printer. The command easily allows left or right justification of numeric or string output; filling with blanks, zeros, or asterisks; and printing special characters at specified locations in the numeric or string output.

Other enhancements to the language include IF...ELSE...ENDIF; WHILE...ENDWHILE; FIND, which searches

for characters within strings; DPEEK and DPOKE for single-command handling of 2-byte addresses; and RPUT and RGET, which facilitate input and output of fixed-length records. A new range of commands eases player-missile programming and joystick reading. LVAR lists program variables and their line-number locations. LOMEM eases the movement of low memory. SET modifies many default conditions, from disabling the break key to wrapping player/missile movement to the opposite side of the screen.

The Fast command placed at the beginning of your programs or used when you run (rather than load) programs transforms all line-number references into absolute addresses. When executing a GOTO, GOSUB, FOR, or WHILE, BASIC XL jumps right to the specified line's address, reducing the running time of many programs. A modified Sieve of Eratosthenes (generating 1000 primes) that takes 3 minutes and 11 seconds in Atari BASIC takes only 1 minute and 38 seconds (1 minute and 11 seconds using FAST) in BASIC XL.

BASIC XL will run all Atari BASIC programs.



Photo 2: The keyboard of the 800XL. Note the better placement of the inverse-video key in the lower right corner.

Multi-function RS-232 Transfer Switches

MFJ-1240
\$79.95
Choice of
8 models



Multi-function RS-232 transfer switches let you switch your computer among printers, modems, terminals, any RS-232 peripherals; monitor data/line failure, protect data lines from surges, and use as null modem for less cost than a switch alone.

Switches 10 lines (2, 3, 4, 5, 6, 8, 11, 15, 17, 20). LED data/line indicators monitor lines 2, 3, 4, 5, 6, 8, 20. Metal oxide varistors protect data lines 2, 3 from voltage spikes and surges. Push button reverses transmit-receive lines (2, 3). PC board eliminates wiring, crosstalk, line interference. Connects any one input to any one output.

Model	Price	In	Out	Model	Price	In	Out
MFJ-1240	\$79.95	1	2	MFJ-1244	\$139.95	3	3
MFJ-1241	\$99.95	2	2	MFJ-1245	\$169.95	3	5
MFJ-1242	\$119.95	2	3	MFJ-1246	\$199.95	5	5
MFJ-1243	\$119.95	1	4	MFJ-1247	\$99.95	1	2

switches 20 lines

AC Power Centers

MFJ-1108
\$99.95

MFJ-1108, \$99.95. Add convenience, prevent data loss, head bounce, equipment damage. **Relay** latches power off during power transients. **Multi-filters** isolate equipment, eliminate interaction, noise, hash. **MOVs** suppress spikes, surges. 3 isolated, switched socketpairs. One unswitched for clock, etc. Lighted power, reset switch. Pop-out fuse. 3 wire, 6 ft. cord. 15A, 125V, 1875 watts. Aluminum case. Black. 18x23/4x2 in. **MFJ-1107, \$79.95.** Like 1108 less relay. 8 sockets, 2 unswitched. **MFJ-1109, \$129.95.** Like 1107 but intelligent. Switch on device plugged into control socket and everything else turns on. Others available.



Acoustic/Direct Coupled Modem



Use with any
phone anywhere
MFJ-1233
\$129.95

MFJ-1233 Acoustic/Direct Coupled 300 baud modem. Versatile. Use with virtually any phone, anywhere. Use battery or 110 VAC. **Direct connect mode:** Plug between handset and base. Use with single or multi-line phones. **Acoustic coupled mode:** Use with phones without modular plugs. Quality muffs give good acoustic coupling, isolates external noise for reliable data transfer. Originate/answer. Self test. Carrier detect, ON LEDs. RS-232, TTL compatible. Reliable single chip modem. Crystal controlled. Aluminum cabinet. 9x1 1/2x4 in. Other models available.

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**MFJ ENTERPRISES
INCORPORATED**

921 Louisville Road, Starkville, MS 39759

REVIEW: ATARI 800XL

The power supply of the 800XL is completely external.

The much-maligned DOS is actually quite effective and easy to use. Typing DOS from BASIC puts the DOS menu on the screen. Little training is required to print a directory; copy files and disks; lock, unlock, rename, and delete files; or format and write new DOS files. The commands offer flexibility that you can augment with a plethora of third-party software.

Nonetheless, DOS 2.0 has several important problems. Loading DOS from BASIC replaces part of the memory in which a BASIC program resides. Preserving the program requires using a special MEM.SAV file, which takes a distracting amount of time. When you call DOS, programs resident in memory are first saved to MEM.SAV then restored when you rerun BASIC. For many programs it is much faster to save the program, call DOS, and then reload the program. BASIC XL and other third-party DOS patches solve much of the problem by allowing access to several DOS commands directly from BASIC.

DOS 2.0 formats disks into 40 tracks at 18 sectors per track (128 bytes per sector in single density). Of the 720 sectors available, three boot the system, eight contain the disk directory, one contains the volume table of contents, and sector 720, by accident, is unaddressable. As a result, there are 707 sectors for data. Total storage per disk is only 88,375 bytes. DOS 3.0, now shipped with the Atari 1050 disk drive, offers enhanced density, which involves the same 40 tracks now with 26 sectors per track, giving the drive about 127K bytes of storage. Several third-party manufacturers offer true double-density drives.

Except for the addition of the parallel bus, the back panel of the 800XL provides the same capabilities as the 800. Both contain a 13-pin I/O (input/output) connector, provision for

TV or monitor output, a channel 2 or 3 selector, a power jack, and the on/off switch. Unlike the 800, the 800XL's power supply is completely external.

SOFTWARE AND PERIPHERALS

In addition to Atari BASIC, Atari also offers Microsoft BASIC, Pilot, Logo, Pascal, an Assembler Editor cartridge, and FORTH. Several of those packages were available from APX (Atari Program Exchange), which no longer exists. *Antic* magazine is attempting to fill this void. OSS supplies BASIC A+, BASIC XL, Action! (see the text box "Action! A Poor Man's C?" on the right), C/65, and the MAC/65 assembler. Three BASIC compilers are available from Datasoft, Monarch, and MMG. MMG claims that its recently released package compiles floating-point and I/O operations.

The most popular word processors are AtariWriter and Letter Perfect (from LJK). Letter Perfect can be integrated with LJK's database manager, Data Perfect, and a spelling checker, Spell Perfect. Documentation has been improved with easy-to-follow tutorials. Data Perfect lets users define their own databases and integrate fields into Letter Perfect. The two together would let a user send the same letter to a list or sublist defined in the database. The spelling program allows expansion of the dictionary to 255 disks and offers a sounds-like feature to help determine whether words are misspelled.

With a separate printer driver, AtariWriter supports a range of printers. LJK supplies a printer driver with Letter Perfect, which can also support 80-column formats and double density. Other available software includes VisiCalc to a new accounting series from Miles Computing of Van Nuys, California, thousands of games, and a variety of excellent graphics aids.

An impressive and growing number of third-party peripherals are available for the Atari 800XL. For disk drives, consumers can select the Atari 1050, the Trak ATD2, the Rana 1000, the Indus GT, Astra Systems' drives, or an

ACTION! A POOR MAN'S C?

BY ED SCHNEEFLOCK

About a year ago, I looked for a better language system for my Atari but neither Atari BASIC nor Atari's Assembler Editor met my needs. I did not want to use BASIC, not only because of its slowness and lack of debugging features, but also because it's difficult to use BASIC for work at the machine-language level. The Assembler Editor gives enough speed but takes too much programming time.

At work I was programming in Pascal, and I liked the APX Pascal package. Unfortunately, it requires two disk drives, two more than I had.

I have always had a preference for the C language, so I checked out two C compilers for the Atari. Both are subsets of the complete C language. They lacked some of the control and data structures and, most importantly, the ability to handle data structures (records). More important, although the prices were reasonable, both required that I buy an editor and macroassembler.

Then I heard about Action! from Optimized Systems Software. It is a cartridge-based, fast, structured language that permits using data structures. Ten iterations of the Sieve ran in under 18 seconds, compared to 10 seconds for an assembly-language version I wrote. BASIC took 38 minutes. Moreover, the programs compile faster than anything I have ever seen. Action! is enough like C that I can routinely convert programs

between the two languages. It also comes with its own editor, one of the best I have used on a small system.

Action! is simple enough for novice programmers; part of the manual describes the language features in terms of their BASIC equivalents. Action! is also powerful enough to challenge an experienced programmer. I have used it to write a terminal program, a program to compare two BASIC programs and list the differences, a program to print an alphabetized list of the contents of a group of disks, and several games. I am currently writing a compiler for a subset of Pascal.

Action! has many impressive features. Programs can be compiled from memory or from disk. You can include separate source files by using the INCLUDE compiler directive. A large program can be managed effectively by putting modules in separate files. This language also has a DEFINE compiler directive much like C's. You can define both constants and expressions. Data types include bytes (characters) and signed and unsigned integers. You can use these in single-dimensioned arrays or combined in records.

Pointers and pointer manipulations are one of the language's best features. Pointers make possible some very concise string-handling routines and dynamic storage of data structures like binary trees and linked lists.

Functions and procedures support

local variables, and you can pass parameters to them. Parameters are passed by value only, but you can use pointers when passing a parameter by reference is required.

You can initialize variables with either a value or an address. The latter eases the handling of operating-system addresses. Procedures can also be initialized with an address, making it easy to call operating-system routines from your program.

In short, Action! is a versatile language system. However, it is not perfect. It can't link separately compiled routines. And you cannot have records of arrays or arrays of records (though these can be handled with pointers). All variables are static, so writing recursive routines requires explicit stack manipulation. These shortcomings are more than outweighed by Action!'s advantages.

Action! is unique because it was designed from the start to run on the 6502 processor. This has some important implications. First, it runs very well on the Atari. I have used a full C compiler on another 6502-based microcomputer, and while it worked, I quickly sensed that it was taxing the machine's limits. Compiling took far too long. And there were too many steps to follow to get a program written and running. Action! is easy to use, quick, and efficient. It can exploit the Atari's full power. Action! puts programming for the Atari in a whole new dimension.

assortment from Percom. When Atari temporarily discontinued production of its 850 interface, several manufacturers developed a variety of printer interfaces, some offering RS-232C ports. All non-Atari printers require one of these interfaces.

The Atari computers have some of the most active users groups in the country, many with bulletin boards containing plenty of free software to download. Telecommunications is available to Atari users who own the Atari 850 interface with RS-232C

ports and third-party modems that attach to the joystick ports.

DOCUMENTATION

Unfortunately, Atari appears to be able to market the 800XL so cheaply in part by including minimal documentation. A brief pamphlet summarizes Atari BASIC, and slightly more comprehensive instructions show you how to set up the system. I believe that consumers would prefer to pay more for more respectable documentation.

There are also potentially serious problems with getting equipment repaired. I have had trouble getting disk drives fixed; the nearest service center is two hours away. Moreover, the Customer Service telephone number published in Atari's introductory documentation no longer functions. A toll number now shares with the old number the dubious honor of being perpetually busy.

Still, at the suggested list price, the 800XL is a bargain. I already own one; I may well buy another. ■



The KoalaPad

An
inexpensive
input device
without
a keyboard

BY DONALD R. OSGOOD

The KoalaPad touch tablet and its accompanying software represent one type of approach to making computers easier to use. This problem is currently receiving a great amount of attention from both hardware and software developers. The touchpad concept has been around in expensive versions since the sixties along with the trackball, the light pen, and other location-sensing mechanisms. They provide a faster and more satisfactory method of making selections or inputs to the computer. The KoalaPad is an inexpensive touch-sensitive peripheral.

HARDWARE

The KoalaPad touch tablet is mounted on a 6-inch by 8-inch plastic base with a 4.25-inch square sensitive area. At the back it is about 1 inch thick and slopes toward the front. Two wide, rugged buttons are mounted between the sensitive area and the back edge. The sensitive area is made of black plastic (see photo 1). Another layer of conductive material is mounted beneath the surface layer, and when the two layers are firmly pressed together by a finger or stylus, a resistance proportional to the position of the selected point in both *x*- and *y*-axes is detected. This serves as an input to the game port of the Apple computer just as would the potentiometers of a joystick. A cable with connector is mounted on the back of the KoalaPad, which plugs into the Apple game connector. The layout of the sensitive area of the pad is similar to that of the high-resolution screen, with the 0,0 coordinates at the upper left-hand edge. Actually, however, the minimum value attainable for the *x*-coordinate is greater than zero—on the order of 6 to 9, while the maximum is about 256. The KoalaPad utilizes 5-volt power from the computer and draws approximately 20 milliamperes.

SYSTEM REQUIREMENTS

System requirements for use of the version of the KoalaPad that I tested include a 48-

byte Apple II, II+, or IIe computer with Applesoft BASIC, one disk drive, DOS 3.3, and a color monitor or television. Although the manufacturer specifies a color monitor or television, I was able to try many of the functions of the system using a standard green-screen monitor. However, a color TV gave much better drawings. Other versions of the KoalaPad are made for Atari, IBM, and Commodore computers.

SOFTWARE

I tested two sets of software with the KoalaPad: the Micro Illustrator (see photo 2) and the Instant Programmer's Guide. The first uses the features of the KoalaPad to provide tools for drawing shapes, lines, points, etc., and for storing and retrieving pictures. It includes utility programs for formatting disks and locking, unlocking, and deleting files. The Instant Programmer's Guide demonstrates a number of segments that a BASIC programmer can incorporate into personal programs.

After you boot the Micro Illustrator disk, the computer displays a menu showing the options of the program. You make selections by using the KoalaPad to move the cursor to the desired option, then touching a button on the pad. Only the storage options require you to use the computer keyboard. The default selection is "Draw;" "Normal;" "Cursor;" and "Green" for the color. A press of a button on the pad blanks the screen and you are ready to start drawing.

In this mode, a cursor appears when you touch the surface of the pad. By holding down the left button while moving your finger or the stylus over the pad, you produce a continuous line. When you release the button, drawing stops and the cursor reappears so you can start a new line. In order to return to the menu, you remove your finger from the pad and press the button.

The Micro Illustrator menu offers a selection of 10 drawing modes plus an erase

(continued)

Donald R. Osgood (2404 Peach Ln., Pasadena, TX 77502) is a retired data-systems engineer who formerly worked for the National Aeronautics and Space Administration. He now works in the Biomedical Engineering Department of the Bayshore Medical Center in Pasadena, Texas. He uses an Apple II, an Apple III, and an IBM Personal Computer.

AT A GLANCE

Name

KoalaPad touch tablet, Micro Illustrator program, and Instant Programmer's Guide

Manufacturer

Koala Technologies Corp.
3100 Patrick Henry Dr.
Santa Clara, CA 95050
(408) 986-8866

Size

6 by 8 by 1 inches; active area 4.25 square inches

Weight

Approximately 1 pound

Hardware Needed

Attaches to the game controller port of the Apple, Atari, Commodore, and IBM Personal Computer

Software Provided

Micro Illustrator; the Instant Programmer's Guide, available separately, also was tested. Several other programs are available from the manufacturer. The system works as a joystick with a number of games.

Documentation

Two 15-page pamphlets

Price

Approximately \$125; extra software about \$35-\$40

function, normal or magnified scale, storage utilities, and a help screen (see table 1). You also can select a standard cursor or any of eight "brushes" (see photo 2) that leave lines of varying contour on the screen. Color choices include two sets of 9 colors (black and white are included in both sets, which means that there are actually 16 colors).

The Instant Programmer's Guide includes a number of sample programs and subroutines. It shows how to use the pad as a tone generator and how to generate a cursor for selecting options in your program. The program menu lists eight selections:

- KoalaPad Fundamentals—this demonstrates the plotting of points and lines and the use of the pad as a tone generator.
- Hi-Res Cursor—demonstrates how to use a shape table to generate a

cursor.

- Compatibility—discusses the use of the KoalaPad instead of a joystick or a set of game paddles.
- Make Your Own Cursor—tells how to generate a cursor using a data statement.
- Soft Keyboard Ideas—discusses ways to put areas of different sizes on the screen.
- A Text Cursor—shows how to move the cursor around.
- An Invitation—offers the user the opportunity to produce KoalaPad software for publication by the manufacturer.
- Quit—the final menu item worked well.

DOCUMENTATION

The documentation received with the KoalaPad consists of a pamphlet of 15 pages, which describes the Micro Illustrator program as well as the in-



Photo 1: The KoalaPad provides a method for entry of data or for making selections from the screen using touch rather than the keyboard.

stallation and operation of the system. It also lists and briefly discusses the commands and gives some hints for using the system as well as a glossary of terms.

The Instant Programmer's Guide includes a pamphlet that essentially contains the text of the tutorials shown on the accompanying disk. It contains a few errors and is succinct to the point of sketchiness, but it is also clear and lucid.

There are areas in the KoalaPad system that would be enhanced by more detailed documentation.

CONCLUSIONS

The KoalaPad is certainly a lot of fun to play with. It does very well at generating simple shapes that look as well as can be expected with the limitations of the Apple Hi-Res screen (see photo 3). The subroutines provided enable BASIC programmers to incorporate the pad into their programs for use as a selection mechanism or as a substitute for either paddles or joysticks.

In the area of freeform drawing or in any use requiring raw data to be plotted, the KoalaPad I tested suffers from severe limitations. I was unable to produce any kind of line drawing that didn't have glitches and spurious lines, jagged lines, and generally unsatisfactory characteristics. However, in a conversation with one of the software marketing people at Koala Technologies I was told that most of the problems associated with raw data have been eliminated in later versions of the touch tablet.

The manual recommends use of the system to provide not more than a 7-by 7-inch grid of touch-sensitive points because of the danger of overlap. This appears to be a reasonable indication of the discrimination capability of the system. The fact that you have to position the cursor and then push a button means that there is little, if any, advantage to using the KoalaPad rather than using the keyboard for selections.

The use of color makes a big difference in drawing geometric shapes in conjunction with the Micro Illus-

trator program. Most of my early tests were done on a green-screen monitor and I was very favorably impressed when I hooked up a color television.

The highly saturated colors and the three-dimensional effects that can be achieved with color are excellent.

(continued)



Photo 2: The Micro Illustrator software is provided with the KoalaPad to permit easy preparation of drawings and figures.



Photo 3: Using Fill, you can color in shapes drawn with the Lines mode. Box, Circle, and Disc also are available modes.

Table 1: The KoalaPad's operating modes and options.

MODE	DESCRIPTION
Point	A cursor or brush marks a single location each time the button is pressed.
Line	The cursor is used to specify the origin and end point of a line. After the cursor is positioned at the starting point, the button is pushed. The line then follows the cursor until a second push of the button releases the line in its final position.
Lines	This mode is similar to the Line mode except that the end point of each line serves as the starting point for the next line.
Rays	The cursor is set to the end point of one line and the button pressed. It is then moved to the origin, which establishes one ray. When the button is held down and the stylus touched to the pad additional rays are generated, frequently several from a single touch of the sensitive surface.
Frame	In the Frame mode the locations of two opposite corners are specified and the program draws a rectangle through those points.
Box	A frame filled with a specified color is produced.
Circle	The center point and radius are indicated by positioning the cursor, then the program draws an approximation of a circle of the indicated size and center location. This is one of the least satisfactory figures that can be drawn on the high-resolution screen.
Disc	Provides a color-filled circle.
Fill	The closed area on the screen in which the cursor is positioned is filled with the active color.
Erase	A color specification is requested then used to fill the entire screen.
Magnify	Enlarges the area around the cursor by a factor of seven. This function permits work on the fine details of a shape.
Normal	Returns to normal from the Magnify mode.
Help	Calls up a set of detailed instructions about the other modes.
Storage	Brings up submenus that permit loading and saving graphics using the computer keyboard for control inputs. The user can catalog, load, or save files, or use a set of disk utilities that are provided to format a disk or to lock, unlock, or delete files.

The KoalaPad system provides a means for interaction with the computer by using a finger or stylus to move a cursor.

The tests using a joystick with the Micro Illustrator program showed that it is just about as easy to use as the touchpad. For some applications, the joystick would probably be better.

IN BRIEF

The KoalaPad system provides a means for interaction with the computer by using a finger or a stylus to move a cursor on the screen. The Micro Illustrator software that accompanies it has a good deal of capability. As a matter of fact, it far exceeds the capability of the hardware portion of the system. The shape-generating modes and color graphics are truly impressive. Limitations of the system are due to the small size of the active area, the lack of control over glitches in some modes, and the difficulty in resolving small differences in input without a great deal of random variation. ■

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Conducted by Steve Ciarcia

SPEED UP A MICRO

Dear Steve,

I hope I am not asking for the moon, but how does one speed up a microprocessor? Will doing that cause problems in the operation of the computer?

A. C. POSADA
Charlottesville, VA

Microprocessor instructions require a specific number of cycles to execute. These cycles are timed by a system clock, and the speed of the computer is a direct function of the clock frequency. Increasing the frequency of the system clock, simply by changing a crystal or divider circuit, will increase the overall execution speed, but there are some limitations.

The microprocessor chip itself has a speed limitation, so when the clock frequency is increased, often a higher-speed version must be used. This is usually what the letter at the end of the chip number signifies.

The memory chips are also affected by speed and must be replaced with faster versions. Otherwise, additional wait states, which reduce some of the benefits of the increased speed, will be needed. Some of the peripheral driver chips may become speed-limited, also reducing the overall throughput.—Steve

65816 ATARI?

Dear Steve,

I have been considering upgrading my Atari 800 by installing a 65816 chip in place of the 6502. According to the advertisements, the chip is software- and hardware-compatible with any machine using a 6502. The lure of a 16-bit processor able to directly address 16 megabytes is hard to resist, but I am worried.

If the chip from Western Design Center is all that it is claimed to be, why isn't everybody installing it instantly?

JAMES E. RAINEY
Coos Bay, OR

The new 65816 microprocessor chip has a 6502 emulation mode. In this mode, it is pin- and software-compatible with the 8-bit 6502 that is used in your Atari 800.

When used to its full capability, addressing 16 megabytes requires a 24-bit address bus. The 65816 handles the extra 8 address bits by multiplexing them with the data bus. On one half of a clock cycle, the pins are used for address lines; on the other half cycle, for data lines. This multiplexing requires additional circuitry, which is not readily adaptable to your Atari. This is why it has not become widely used.

A complete description of this new chip can be found in the August and September 1984 issues of BYTE in a two-part article by Steven P. Hendrix, "The 65816 Microprocessor."—Steve

HALF-INCH TAPE BACKUP

Dear Steve,

I've been frustrated for a long time because most microcomputer manufacturers don't offer 1/2-inch tape drives as an optional accessory. The only one I know of that does is Wicat.

Most of them offer 1/4-inch streamer tape for backing up hard disks, but 1/2-inch tape would seem to be an ideal bridge over a wide gap between many mainframe systems and micros. For instance, my firm, a nonprofit organization, maintains a large mailing list with a data-processing service. I've spoken to the people there, and they have neither floppy-disk nor modem capabilities. The only way they can communicate is via 1/2-inch tape. I have gone the route of transferring from tape to floppy disk, but that is cumbersome and expensive (not in principle, but in practice); few firms offer this service, at least in this area. We could save a lot of money (in keyboarding time and errors) if we could write 1/2-inch tapes.

I've resisted purchasing the 1/4-inch streamer-tape unit that Molecular, the manufacturer of one of our computers, offers because a 1/2-inch tape drive would allow me to easily back up my hard disk and communicate with the big fellows, assuming enough compatibility were built in. I assume the larger tape drive would cost two or three times as much as the smaller ones do, but it would be worth it to gain both the larger capacity and ability to communicate.

Do you know of anyone offering a solu-

tion to this problem or planning to address it? Would a controller have to be built for each type of micro, or could something be set up to run from a serial port?

STEVE GOLDFIELD
San Francisco, CA

Overland Data Inc. sells a 9-track tape controller for the IBM PC. It is capable of reading and writing industry-standard 1/2-inch tape and is compatible with most 9-track formatted tape drives. It operates with tape-drive speeds up to 120 inches per second and allows data transfer at rates up to 192,000 bytes per second. It sells for \$880 and can be purchased from Overland Data Inc., Suite A, 5644 Kearny Mesa Rd., San Diego, CA 92111, (619) 571-5555.—Steve

TALL ORDER

Dear Steve,

I make my living writing software, and my only exposure to hardware has been through building several Heathkits. I would like to build a computer system from board level, since it would enable me to create a system to suit my needs. Also, it would probably be cheaper than purchasing a Heath H-100, for example. Just about all I know hardware-wise is the difference between an S-100 bus and a DB-25 connector—I could not tell you the difference between a switching and nonswitching power supply.

How hard is it to get an operating system/software for a machine that I put together myself? What are other major advantages and disadvantages that I should be aware of? Can you recommend some books that can get me up to speed with hardware?

JEFFREY SHULMAN
Highland Park, NJ

Building your own computer from scratch is quite different from assembling Heathkits. If you want to get some idea of the scope of the job of designing and building a computer with capabilities on the order of the H-100, read my articles on the MPX-16 in the November and December 1982 and January 1983 issues

(continued)

BOOK REVIEWS

user is encouraged to try examples that build on each other in the learning process.

Because the guide covers the family of CP/M, it is good for people who want to use more than one version. The appendixes are not only well written but prove to be good references for the user who has some familiarity with CP/M. However, Sachs does not explain the CP/M-86 assembly language or the 8086 instruction set other than the syntax for ASM-86.

Paul W. Lowans (2709 South Union St., Spencerport, NY 14559) is an electronics engineering technician at Xerox Corporation in Rochester, New York.

COMPUTER ANIMATION PRIMER

Reviewed by Jeff Campbell

Computer Animation Primer provides the armchair programmer and would-be computer animator with a fascinating overview of a technology capable of bringing the illusion of reality to our most abstract imaginings. From the high-tech marvels of *Star Wars* special effects to BASIC programs to run on your personal computer, David Fox and Mitchell Waite explore how to become involved in computer animation today.

Fox and Waite begin with a brief history of animation. Antique animation devices with such exotic names as Thaumatrope, Phenakistoscope, and Zoetrope almost seemed to anticipate their computerized futures. The discussion highlights the major advances by animation pioneers like Walt Disney, Walter Lantz, Max Fleischer, et al. The perspective concludes with an examination of how computer animation is used today in the film industry, medical research, sports, education, engineering, advertising, and arcade games.

One section extensively describes the basic hardware used in computer animation. Brief explanations cover everything from the mechanics of creating movement and color on a cathode-ray tube to the light pens, digitizing tablets, and joysticks used to create and manipulate graphics images. The authors conclude this section with the observation that the "trickle-down" effect will continue to allow increasingly sophisticated equipment to become available to the personal computer user.

In a chapter on computer-animation software and applications, Fox and Waite focus on techniques for defining graphics objects in ways that a computer can understand. Some rather complex algorithms come into play when images are rotated, translated, and scaled, yet these discussions do not bog down. The text is lucid, and the authors are not above an occasional humorous touch.

SAMPLE PROGRAMS

The bulk of the book deals with actual programs for animating on a personal computer. The authors have

(continued)

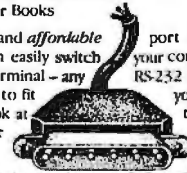
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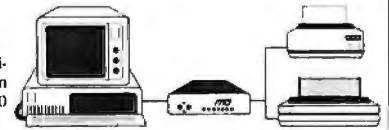
Joe Campbell, *The RS-232 Solution*
Sybex Computer Books

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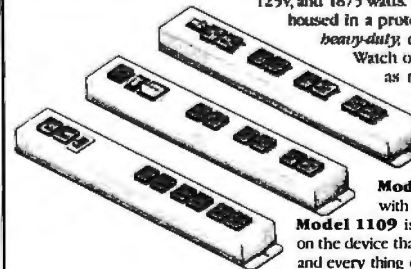


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BOOK REVIEWS

chosen to work with Atari BASIC because they think it has high potential for graphics and animation. The programs themselves are widely adaptable for use on other micro-computers. Fox and Waite provide instructions for creating customized character sets (or making do with the ones you have) and then animating them. They cover animation loops; with this information you can create galloping horses, a walking man, or an exploding bomb. Movement can also be suggested by changes in color. This is covered in a section on color-register animation.

Separate chapters deal with player-missile graphics, employed in many arcade games, and using machine language in BASIC programs. The final chapter offers the information necessary to create scrolling backgrounds. By applying this knowledge, it's possible to create some very impressive animated graphics.

VISUAL EFFECTS

The layout of this book deserves special mention. Wide margins on the outside of each page not only contribute to an uncluttered page but allow the inclusion of four "flip book" computer-animation movies. By flipping through the upper corners of this book—both forward and backward—you can view approximate real-time segments of the animation discussed in the book. Fox and Waite use one of the oldest animation techniques to elucidate one of the newest.

The book also has a 16-page color section. Appendixes include a compilation of all program listings reproduced in larger detail, a character-set grid, listing conventions for representing hidden (or invisible) characters, methods for storing machine-language routines in strings, parameter-table entries for black-box routines, source-code listings of assembly-language routines, and Atari hardware and shadow registers.

Computer Animation Primer is the book for people who want action livening up their computer screens.

Jeff Campbell (9296 West 98th Place, Broomfield, CO 80020) is president of Campbell Photo/Graphics.

**THE COMPLETE HOME EDUCATOR:
A COMPREHENSIVE GUIDE
TO MODERN HOME-TEACHING**
Reviewed by Hunter Holmes Alexander

Many parents despair of the public schools but few act to set things right. *The Complete Home Educator: A Comprehensive Guide to Modern Home-Teaching* is a step-by-step handbook for teaching youngsters at home. It is also a book about the mediocrity of schools and how micro-computers can be used to improve education.

Mario Pagnoni, a teacher for 13 years, decided to leave his school in order to teach his two sons math, computer skills, writing, spelling, and problem solving at home. He

(continued)

6502 TRICKS AND TRAPS

BY JOE HOLT

Tips for surviving 6502 assembly-language programming

WITH THE ADVENT of complex microprocessors whose operation codes (op codes) begin to resemble some high-level languages, the days of the 6502 seem numbered. Indeed, a microprocessor with only three 8-bit registers and a 64K-byte address space is apparently no match for a piece of silicon that can walk through 4 gigabytes of memory in 32-bit strides and work with hundreds of bits worth of registers. I won't try to fool you: The 6502 will *not* be around forever. But when the last of its species emerges from the forge, it will be joining an installed base of more than 3 million 6502-based computers. There is merit, therefore, in discussing the peculiarities of this dying breed, the ins and outs of this most nonorthogonal microprocessor.

The 6502 has three 8-bit registers (only one of which can be used in arithmetic and Boolean operations), a single-page (256-byte) fixed stack, and optimized performance when dealing with the first 256 bytes of memory. But what may be considered a tight architecture is befuddled by an instruction set full of inconsistency and seeming favoritism to certain combinations of addressing modes and op codes. Steve Wozniak even admitted that the only reason he put a 6502 in his Apple II was because it was cheap.

In order to gain the most benefit from the 6502, an assembly-language programmer must understand these idiosyncrasies and use them to his or her advantage.

PECULIARITIES

I will assume for the sake of brevity that you are already familiar with the 6502's architecture and operation codes (and assembly language in general) and perhaps have ac-

cess to an Apple or Atari with a decent assembler. If not, you might want to pick up a good reference book on the 6502 and sit down with an assembler and experiment. An intimate knowledge of your machine is the greatest boon to any programming task.

ZERO PAGE

The first two pages (512 bytes) of address space have special meaning to the 6502. The first page, called the Zero page, consists of memory addresses 0000 to 00FF [Editor's note: All addresses are in hexadecimal unless otherwise specified.] and is considered prime real estate for variable storage. Memory references to the Zero page by most op codes can be reduced to 1 byte because the 6502 has a special addressing mode strictly for this area of memory. Not only are programs that place variables on the Zero page shorter, but they also run faster because the microprocessor need only fetch 1 byte from the program to determine the memory address. The upper byte of the address (00xx) is supplied internally. For example, the following sequence assembles to 6 bytes and executes in eight clock cycles:

```
300:AD 80 03  LDA $380 ;get value
303:8D 81 03  STA $381 ;and stuff it elsewhere
```

The equivalent sequence using Zero-page variables assembles to only 4 bytes and executes in six clock cycles:

```
300:A5 80      LDA $80 ;get Zero-page value
```

(continued)

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```
302:85 81    STA  $81    ;and stuff it elsewhere
```

Where speed and space are critical, there is no better solution than to put oft-used variables on the Zero page. But beware: Other programmers before you have done the same, so it's important not to alter Zero-page memory locations already used by your computer's ROM (read-only memory) routines or DOS (disk operating system).

THE STACK

The second page consists of memory addresses 0100 to 01FF and is the location of the 6502's stack. Because the entire stack can be addressed by 9 bits, the stack pointer is 8 bits wide with the upper bit (01xx) supplied internally. You can only set this 8-bit stack pointer via the X register; you must place the value in the X register and transfer it to the stack pointer with the TXS (transfer X register to stack pointer) op code. Because the stack grows downward, it is good practice to initialize the stack pointer at the beginning of any 6502 program with the following code:

```
300:A2 FF    LDX  #$FF    ;set pointer to very top of stack
302:9A      TXS
```

Conversely, the only way you can read the stack pointer is through the X register, with the TSX (transfer stack pointer to X register) op code. This instruction is handy for "locating yourself" in a relocatable program, a topic I'll describe later.

The stack never grows so low that it clobbers the Zero page. Instead, the stack pointer wraps from 0100 back up to 01FF, possibly causing confusion if you've already got a page full of variables or return addresses pushed onto the stack. This situation can be kept in check by limiting the use of recursive subroutines.

FLAGS

The 6502 is notorious for how it handles its flags, especially the Carry flag. Where most processors set the Carry flag when a borrow occurs from a subtract operation, the 6502 produces a *clear* Carry to indicate a borrow. The following is an illustration with the SBC (subtract with Carry) instruction:

```
300:38      SEC          ;be sure the Carry's set
301:E9 01    SBC  #1      ;decrement the
                        accumulator
303:90 ..    BCC  BORROW ;a borrow occurred
```

You've probably noticed the lack of add and subtract op codes on the 6502 that do not include the Carry flag. This oversight necessitates setting (for SBC, as above) or clearing (for ADC—add with Carry) the Carry before performing one of these operations.

The backward Carry for subtract operations is not in itself confusing, that is, until you realize that compare operations (CMP, CPX, CPY) are actually subtracts in compares' clothing. Logical compares are accomplished within most

microprocessors by simply subtracting from the value being compared the value to compare with and tossing away the result. In other words, comparing 5 to 6 would be a matter of subtracting 6 from 5 and setting the appropriate status flags. In this situation (5 minus 6) a borrow would occur, indicated by a *clear* Carry. Therefore, after a compare operation, a clear Carry indicates less than, and a set Carry indicates greater than or equal. This is *backward* from the logic of all other popular microprocessors.

The other flag that you should be wary of is the Decimal flag. When set, all arithmetic operations are performed in BCD (binary-coded decimal). This is wonderful if you intend to perform BCD mathematics, but it can cause all kinds of unexplainable problems if not. Consequently, you should start any 6502 program with a CLD (clear Decimal flag) operation. Set the Decimal flag only when necessary and clear it immediately afterward.

The way the 6502 decides to set or clear its flags after different operations is not immediately obvious, and the logic behind this is somewhat different from that of most other microprocessors. For example, the Carry flag is only affected by arithmetic (ADC, SBC, and compares) and shift operations (ASL, LSR, ROL, and ROR), except when explicitly changed (with CLC, SEC, or PLP). Operations that affect the Carry flag on many other processors, such as Boolean operations (AND, EOR, and OR), do not modify the Carry at all. Increment and decrement operations do not affect the Carry either, but this is only a problem when testing if a register or memory value was decremented past 0, in which case you have to execute an explicit comparison:

```
300:CA      DEX          ;count down
301:E0 FF    CPX  #$FF    ;past zero?
303:F0 ..    BEQ  ROLLUNDER ;yes
```

The two flags that are set or cleared in conjunction with most operations are the Negative and Zero flags. The Negative flag reflects the state of the eighth (most significant) bit of the result of the operation, and the Zero flag is set whenever the result is equal to 0 (all bits cleared). All operations that work with a value set these flags, including the load (LDA, LDX, and LDY) and transfer (TAX, TAY, TSX, TXA, TXS, and TYA) op codes.

THE BIT INSTRUCTION

Although the 6502's instruction set includes no operations for bit manipulation (short of Boolean operations), a special instruction can be used to examine the eighth (most significant) and seventh bits of a value in memory. This is the BIT op code, and when used it will place the eighth bit of the memory referenced in the Negative flag and the seventh bit in the Overflow flag without affecting the contents of any register. This has the most benefit when you use it to test if a Boolean variable (that is, one that is either 00 or FF) is set or not:

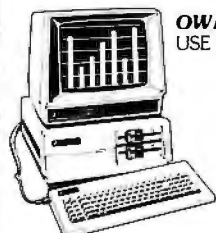
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6502 TRICKS AND TRAPS

```
300:24 80 BIT ALLDONE ;are we done?
302:30 .. BMI DONE ;yes
```

The BIT operation also has the side effect of setting or clearing the Zero flag depending on the result of a logical AND operator between the memory value and the accumulator. This feature (really the main purpose of the BIT operation) has little use outside of testing status bits in a memory-mapped I/O machine.

SAVING X AND Y

To complete the discussion of the 6502's peculiarities, I should mention that there is no provision to push or pop the contents of the X or Y registers. If you need to preserve the contents of either of these registers, there are two paths you can take. The first and most logical one is to save the contents on the stack, but you can only do this by transferring the register to the accumulator and then pushing the accumulator onto the stack. To restore the register, you must pop the accumulator from the stack and transfer its contents back to the appropriate register:

```
300:8A TXA ;save the X register
301:48 PHA
```

```
325:68 PLA ;now restore the X register
326:AA TAX
```

The disadvantage of this method is obvious: The original value in the accumulator is destroyed, and it is not a simple matter of pushing and popping the accumulator around each sequence to preserve it. You must temporarily save the contents of the accumulator either in the remaining register or in some memory location. Neither situation is desirable. (Of course, if the accumulator isn't holding anything of any consequence, then this disadvantage can be ignored.)

Your alternative is to store the register in memory somewhere and then load it back when required. This has the advantage of placing the register's content where it can be easily accessed (by LDX, STX, LDY, and STY op codes), but it forces you to set aside a specific location just for preserving a register. Things get really messy when this occurs in a recursive routine or if the location for saving the register is also used someplace else for the same purpose. In either case, havoc will ensue. The bottom line is that no solution is perfect, and you must examine the situation carefully to decide what will work best.

TRICKS

Tricks (or "hacks") are techniques that use a feature or deficiency in the programming environment to an advantage not anticipated by the system designer. If you use them with caution, they can result in faster, more compact object code.

In the 6502's case, there are dozens of these optimization tricks, each of which saves bytes and cycle time. Some

(continued)

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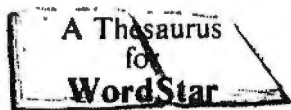
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6502 TRICKS AND TRAPS

of the tricks described here are not necessarily applicable just to the 6502 but are simply good programming practices. Nonetheless, they are essential to using the 6502's full potential.

BRANCHING

One of the glaring holes in the 6502's instruction set is the absence of an unconditional relative jump (or branch). This makes writing relocatable code difficult, and many times it seems a waste to have to use 3 bytes for a jump instruction just to skip over 1 or 2 bytes. One way you can get around this is by using a conditional branch when the state of a flag is guaranteed. For example, because a load operation always modifies the Negative and Zero flags, this type of sequence is possible:

```
300:C9 05    CMP #5           ;less than 5?
302:B0 ..    BCS NOTLESS     ;no
304:A9 01    LDA #1          ;yes, set to 1
306:D0 ..    BNE CONTINUE    ;--- always taken
```

Because the accumulator is loaded with 1, the Zero flag will always be clear, in which case the BNE (branch if not equal) will always be taken.

If you do not know the state of a flag for certain, but you must use a branch instead of a jump (perhaps you are writing some relocatable code), you can always force one of the flags to a known state and branch on that condition. Because the Overflow flag is seldom used, it finds itself the most likely candidate:

```
300:B8      CLV               ;clear overflow for branch
301:50 ..   BVC SMORE         ;--- always taken
```

This sequence takes just as many bytes as an equivalent jump (JMP) instruction, with the one disadvantage common to all 6502 relative branches: They can only jump forward 127 bytes or back 128 bytes.

One other trick involves the misuse of the BIT operation. Because the BIT operation does not affect any registers and only the Zero, Negative, and Overflow flags, it can be put to good use as a "skip over the next 2 bytes" instruction. For example,

```
300:C9 05    CMP #5           ;less than 5?
302:B0 03    BCS NO           ;no
304:A2 FF    LDX #$FF         ;yes, set to true
306:2C      DFB $2C           ;--- BIT trick
307:A2 00 NO: LDX #0          ;no, set to false
309:86 80    STX AFLAG        ;save true/false status
```

If the condition is true (less than 5), the X register will be loaded with the value FF, then a nonsense BIT instruction occurs, after which execution continues. If the condition is false, NO will be branched to, which loads the X register with 00. In one sense, the operation immediately following the LDX #\$FF is a BIT operation with memory address 00A2, but in another sense, that memory address operand (00A2) disassembles to the instruction LDX #0.

6502 TRICKS AND TRAPS

This trick of hiding code within the operand of other code is an old one but should nonetheless be used with caution.

This BIT technique can also be used to skip over 1 byte by using the Zero-page addressing mode for BIT, in which case the value for the DFB (define byte) pseudo-operation would be 24.

ADDING AND SUBTRACTING

Because of the lack of add and subtract operations that do not include the Carry, the sequences CLC, ADC and SEC, SBC are common ones. There is one way to avoid having to explicitly set or clear the Carry, but only if the Carry is in a known state. For example,

```
300:C9 05    CMP #5           ;less than 5?
302:B0 ..    BCS NOTLESS      ;no
304:18       CLC
305:69 05    ADC #5           ;yes, put it above 5
```

Because the Carry flag will *always* be clear if the branch is not taken, the CLC before the ADC instruction is unnecessary. You must be careful to ensure that the condition of the branch does not change, however.

If the Carry flag is in the wrong (but known) state, it can still be used to your advantage if the operand for the ADC or SBC is immediate:

```
300:C9 05    CMP #5           ;less than 5?
302:90 ..    BCC LESS        ;yes!
304:69 04    ADC #5-1        ;(or 4)
```

In this example, the ADC operation will still add 5 to the accumulator because the Carry will always be set and will therefore be added along with the 4.

INITIALIZATION

There are many places in a program where a number of variables must be set to certain values. Usually, the code looks like this:

```
300:A9 FF    LDA #$FF        ;set a few true/false vars
302:85 80    STA VAR1
304:85 81    STA VAR2
306:A9 00    LDA #0          ;clear this one
308:85 82    STA VAR3
30A:A9 01    LDA #1          ;and initialize another
30C:85 83    STA VAR4
```

If the X or Y register can be sacrificed, the fact that the values being stored are consecutive can be exploited:

```
300:A2 FF    LDX #$FF        ;set a few true/false vars
302:86 80    STX VAR1
304:86 81    STX VAR2
306:E8       INX             ;now we're up to 0
307:86 82    STX VAR3        ;clear this one
309:E8       INX             ;now we're up to 1
30A:86 83    STX VAR4        ;and initialize another
```

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Note that this only reduces the size of the code; there is no savings in speed (an INX op code takes just as many clock cycles as an LDA #).

LOCATING YOURSELF

Often it is necessary to know the location of code that is executing in a relocatable environment. If there is within the system the location of a known RTS instruction (perhaps in ROM), this can be accomplished by calling this RTS, then examining the remains on the stack. The following example will determine what page the executing code is on:

```
300:20 58 FF JSR KNOWNRTS ;get return address
                        ;on the stack
303:BA      TSX
304:BD 00 01 LDA $100,X    ;now get what
                        ;page we're on
```

There is a special consideration when using this type of code. If there is the possibility of a 6502 interrupt occurring (from a real-time clock or a communications device), the return address above the stack would be destroyed by the 6502's interrupt processing. It would be wise in this case to turn off interrupts before this bit of code (SEI), then reenable them immediately after the LDA \$100,X (CLI). *[Editor's note: These instructions are two more examples of the 6502's confusing mnemonics. At first glance, you would think that SEI would mean "set interrupts." However, SEI means "set interrupt disable flag"; its execution shuts off the 6502 interrupts. CLI means "clear interrupt disable flag," and a CLI instruction actually enables interrupts.]*

NONINDEXED INDIRECT

One of the nicest features of the 6502 is its abundance of addressing modes, but there are times when even these are not enough. A prime example is the situation when a nonindexed indirect reference must be made. Most of the time, the Y register is sacrificed in this way:

```
300:A0 00 LDY #0          ;index of zero
302:B1 80 LDA (POINTER),Y ;nonindexed
```

But if the Y register is already being used, a similar method involving the seldom (if ever) used preindexed indirect addressing mode can be used, at the expense of the X register:

```
300:A2 00 LDX #0          ;use some register
302:A1 80 LDA (POINTER,X)
```

Of course, you should take advantage of an index register that already contains 00.

INDIRECT JUMPING

Last but not least is a technique for branching to different routines depending on an index value. This can be used for interpreting keyboard commands or executing alternate parts of code based on a certain number. The only limitation is that all the routines must reside on the same

page in memory, but a little extra programming can overcome this. This technique uses an RTS instruction as a kind of indirect jump:

```
300:A9 03 LDA #HIPAGE    ;high byte of
                        ;address routines
                        ;are on
302:48 PHA                ;stick it on the
                        ;stack
303:BD 20 03 LDA ADDRTAB,X ;X contains the
                        ;function number
306:48 PHA                ;fake a 'return'
                        ;address
307:60 RTS                ;go to the routine
```

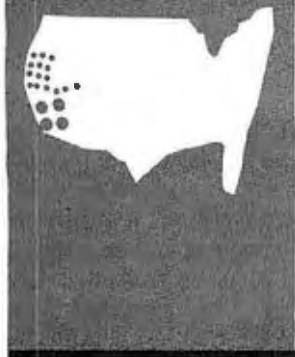
The table ADDRTAB would contain the low byte of each routine *minus one* due to the fact that the 6502's program counter is incremented after the address is obtained for the RTS. This portion of code expects the function number in the X register. First, the high byte of the routines' addresses is pushed onto the stack, then the low byte is obtained from the table and pushed onto the stack. At this point, the stack contains the address of a routine to execute just as if an instruction right before that routine had been a JSR (jump to subroutine; note: JSR actually stands for "jump and save return address"). When the RTS executes, it pulls the address off the stack, increments it, then continues program execution at that address.

THE 65C02

Just when you get used to the idea of having to use all these tricks and have plastered your wall with 6502 peculiarities (as I've done), along comes the 65C02. The 65C02 is a revision of the 6502 that is built into the Apple IIc, is offered as an upgrade to the Apple IIe, and solves many of the problems and voids many of the hacks described above. For example, the 65C02 includes a branch-always instruction, eliminating the need for the known-condition branching tricks. Also included are push and pop X and Y instructions, which eliminate the need for all the tricky register transfers or loading and storing. Another nice addition is the inclusion of increment- and decrement-accumulator instructions, so that it is no longer necessary to resort to arithmetic just for this. A few bugs within the 6502 have also been fixed in the 65C02.

THE FUTURE OF THE 6502

After all is said and done, has all this been purely academic? I think not. Despite its simplicity and peculiarities, the 6502 is still an attractive microprocessor for semi-dedicated machines (that is, game machines, low-priced home computers, etc.). It is a fast microprocessor with a very efficient design. And to tell you the truth, I enjoy programming the 6502 for the very quirks I've been complaining about. I believe there are others who feel the same way, and this if nothing else should guarantee a long and prosperous life for the 6502. ■



A GEM Seminar

**Also, a Mac
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technology**

BY JOHN MARKOFF
AND PHILLIP
ROBINSON

In the March BYTE West Coast (page 355) we mentioned GEM (Graphics Environment Manager), a new program from Digital Research (DR) that gives a computer a Macintosh-like face of icons, windows, multiple fonts, and pull-down menus. In February we attended the GEM Seminar in Monterey, California, where DR began teaching programmers to adapt their software to the GEM environment. What began as an interesting and impressive technical presentation gave way to a marketing brouhaha, which in turn led to a demonstration of DR's flexibility.

Why is GEM so important? DR's John Hiles claims that personal computers with GEM will not only reach the people who read *PC*, *MacWorld*, and *Scientific American* but also will reach those who read *Time* and *TV Guide*. Those people will be more at ease with GEM than with standard operating-system interfaces. DR, the company that once ruled the microcomputer roost with its CP/M operating system for 8-bit microcomputers, hopes to set a new standard with GEM. The Digital Research folks want to provide the advantages of the Mac (and more, such as color displays) to people with other computers. Although the new Atari Inc. under Jack Tramiel (former head of Commodore) is the only company that has committed itself to building GEM into its computers, DR is clearly hoping to penetrate the software-rich, business-standard world of the IBM Personal Computer (PC).

To do this, DR has to do two things. First, it must convince people to use GEM, to build it into hardware and to adapt software to it. Second, DR must teach hardware and software developers how to do those things. Programs will not automatically run on a computer that is equipped with GEM; special files must be added, icons must be designed, and program connections must be developed. (By the way, the bindings for GEM are written in C, though Pascal will be added later. If you want to work with GEM,

you certainly should learn C.)

DR decided to begin its education effort with seminars. The one we attended in Monterey was followed by one in London. The seminars had three goals: to continue to pitch GEM, to demonstrate some of the fundamentals of GEM programming (and hand out a software toolkit full of programming utilities and sample code), and to show doubters that GEM is real. That last goal may seem unnecessary, but the fate of Desq, Visi On, and Windows seems to show that such software environments have been jinxed. Visi On disappeared and almost took one of yesterday's largest microcomputer software firms (VisiCorp) with it. Desq has lapsed into limbo, and Microsoft Windows, from one of today's largest software companies, has been repeatedly delayed. In fact, because GEM competes with Windows as much as it does with the Macintosh, DR was clearly happy to be handing out kits and discussing a real product when Microsoft was still months away from its planned summer release of Windows.

To stress the importance of the seminar, DR handed out a list of the attending companies. These were broken into three groups: software houses, original equipment manufacturers (OEMs), and the press. In all, more than 200 people from 30 OEMs and 105 people representing various software firms were there. However, not everyone came with firm intentions to adapt to GEM. In fact, many would only admit coming to have a look at it or check it out. The list of firm commitments is short but substantial. Atari, ACT (makers of the Apricot computers), Commodore, Northern Telecom, and Texas Instruments have all bought licenses to use GEM. Atari has already employed the license to put GEM in its new ST series of computers. We've heard rumors that Atari isn't alone. The software companies—known at the seminar as ISVs (independent software vendors)—who have announced that they will write to GEM

(continued)

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are Blue Chip, Chang Labs, Hayden, Lifetree, Matrix/Systems Group, Pro-Vue, Quadratron Systems, Schoenburg and Hoxie, Software Products, Spinnaker, and Thorn EMI.

Most of the two-day seminar was devoted to explaining GEM architecture and to walking through GEM program code. Throughout the sessions, the DR team demonstrated GEM running on a variety of IBM machines including a PC AT, a PC XT, and an IBM PC with two floppy-disk drives and 256K bytes of memory. (The PC AT used IBM's advanced graphics adapter with the 640- by 200-pixel resolution.)

A description of GEM's VDI (virtual device interface), which allows programs to think they have control of the terminal when they are in fact being handled by GEM, was followed by a short discussion of fonts. As Lee Lorenzen, senior software engineer for DR, explained, DR is only providing a sans-serif font called Swiss (which looks like Helvetica) and a serif font (which looks like Times-Roman) but is encouraging third-party fonts. In fact, the folks from DR started referring to IFVs (independent font vendors).

Tom Rolander of DR explained some of the tough technical stuff, walking through the code of a sample GEM application he had written (a simple paint program). Then DR's Tim Oren began a detailed overview of the RCS (resource construction set). On Friday morning we completed the RCS overview and then quickly learned how to use the Icon Editor

from Greg Morris of DR (he wrote the editor). Rolander returned to walk us through some more C listings for a simple desk accessory.

Friday afternoon's discussion of marketing set off a small explosion. Have you ever seen a room loaded with loud, hostile, and sometimes profane programmers? Except in software project-status meetings, of course. We witnessed one after the DR marketing team presented the licensing facts about GEM. Basically, we were told that there will be two ways for software developers to work with GEM. They can develop GEM-compatible applications and sell them to people who already have GEM on their computers. That's no market at all right now: No one has GEM. Or they can pay DR a license fee that will allow them to sell the application and GEM in a bundle. This license costs \$1000 per product per year (with no guarantee that it won't rise)—so far, not so bad. But then DR mentioned that GEM would only run on IBM (PC, PC AT, and PC XT) equipment. It wouldn't even run on compatibles like the Compaq. Why? Because DR didn't want it to. DR deliberately wrote GEM—crippled it—so it wouldn't run on clones. Again, why? Because DR wanted hardware manufacturers to pay OEM license fees to have GEM run on their computers. All OEMs except IBM, that is.

DR didn't mention this until the final hours of the seminar. In fact, the DR marketing people didn't hand out the sheets detailing licensing until just before this session. Did they anticipate the attendees' reactions? The software developers certainly didn't anticipate having to support different GEM versions of their applications for every compatible and clone. What had seemed up until then a crowd of programmers willing to give GEM a shot quickly changed. While not everyone objected to the IBM constraint, there were a number of hostile questions from the audience. In fact, when one person asked how many thought GEM's inability to run on the Compaq was a serious limitation, 50 to 60 percent of the attendees raised

their hand. DR responded that it has to make some money on the product and OEM fees are a place to do so. While some developers felt this was reasonable, many others seemed to think they'd been bushwhacked.

Gary Kildall, the president and founder of DR, tried to calm the attendees. Discussions after the conference centered on the marketing plans and what a pain they were. Things looked black for GEM.

Then DR changed its mind. In late February, the folks in Monterey decided to change the code in GEM that checks for machine type. Now, GEM will run on IBM compatibles and clones. Imagine, a sizable software company that really pays attention to its developers and makes major changes because of what it hears.

We were impressed by GEM, as were a number of the developers at the seminar. Everyone went home with two big binders full of some useful information and some fluff, a lot of C code, an invitation to a CompuServe GEM support group, a toolkit disk, and a list of toolkit bugs. While GEM had been in beta test for a couple of months, the toolkit had just reached the beta-test stage and had a number of bugs. For instance, in a certain circumstance, if you tried to drag something out of a menu and then accidentally dropped it on a divider line, the entire computer system would hang and have to be reset.

GEM lets you have the same kind of fun as working with a Macintosh and yet lets you step back into the IBM PC world with a quick exit instruction. GEM even has a limited multitasking facility (it can handle some background processes). It is reasonably quick and thorough, but it does have limitations. For example, it has some arbitrary limits, such as a maximum of four open windows at a time and no more than six desk accessories (and a memory-limit size for those).

At press time DR was planning to release its own GEM applications, including GEM Draw (April), GEM Write and GEM Paint (June), and GEM Graph and GEM Wordchart (July).

How will GEM impact the micro-computer world? Right now that depends mainly on DR, Atari, and Apple. Can DR convince developers to work in a GEM world? Will Atari be able to produce huge numbers of inexpensive GEM machines, as Tramiel claims? And finally, how will Apple respond? If people can have the Macintosh juice in a cheaper computer, or on an IBM PC-compatible, will they continue to buy Macs? Does Apple have the next evolution or revolution (like a cheaper or more powerful Mac) up its sleeve? If so, the Cupertino Corps may well find that GEM's imitation has confirmed Mac ideas and put Apple out in front of the microcomputer race. If Apple isn't ready to take the next step, it may be run over by a horde of "Macalikes" egged on by a smiling DR.

MACNOSY: "A DISASSEMBLER FOR THE REST OF US"

Better software-development tools have become available for the Macintosh during the past half year. Currently there are a number of C programming languages, several assemblers, several BASICs, LISP, Logo, FORTH, Modula-2, and an interpretive Pascal to name just a few. Add a licensed version of Xerox Smalltalk-80, which Apple is rumored to have in the works for release soon, and the Macintosh becomes a reasonable programming environment.

For those who want to go further, programming editors and a variety of debugging tools are now readily available. Possibly one of the ultimate Macintosh "exploring" tools is MacNosy, a sophisticated disassembler written by veteran compiler designer Steve Jasik.

Jasik has written compilers for Control Data Corporation for a number of years and is best known for his work developing a global optimizing FORTRAN compiler for the Control Data Cyber 170 system. While attempting to gain a clearer understanding of the Motorola 68000 and the Macintosh operating system, he grew frustrated with the poor quality of the documentation and the general lack of source

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listings. So he decided to write MacNosy.

Jasik considers his program to be as much a "decompiler" as a disassembler. MacNosy, which consists of more than 7000 lines of Pascal code and about 300 lines of assembly-language code, contains many features associated with compilers including a table manager, symbol-table enter/lookup routines, a reference map, and global flow analysis.

MacNosy runs on either a 512K-byte Macintosh or a 1-megabyte Lisa under the Workshop operating system or the MacWorks environment. It is capable of disassembling the resource fork of an application, ROM (read-only memory), or various resource types in the system file (DRVr, PACK, INIT, CDEF, WDEF, etc.).

A partial list of MacNosy features also includes symbol dictionaries of the ROM names and global symbols (0 to hexadecimal B00) with value-to-symbol substitution, selective listing of procedures in a file by procedure name or substring, the ability to search a program file for references to selected addresses, ROM calls, resource-type references, constant or string references, a full or selective listing of the resources in a file in a format similar to that of the Macin-

tosh Resource Mover, and the ability to translate the segment-relative address of an instruction to the disk-file relative address for code-patching purposes. MacNosy also records its input on a text format .jrnl file for later playback. A future program addition will be a built-in mini-editor for viewing and modifying files while in MacNosy.

Jasik claims that MacNosy is set apart from other disassemblers because it treats a program as a tree of procedures. It begins at the main entry point and does a tree walk to mark the program areas that are procedures. Areas not included are considered data. Currently the program doesn't reconstruct enough information about data areas that are actually code (procedures passed as addresses), and programmer intervention is needed to decode these areas.

In addition to its use as an educational tool and as a tool for developers who want to examine the Macintosh ROM to find out what the ROM routines are doing and for those who want to learn advanced 68000/Macintosh programming techniques by examining others' code, MacNosy has a more controversial use. Advanced programmers can use it to remove copy-protection schemes from commercial software. Jasik takes the position that he is not opposed to copy protection as long as it is not "obnoxious" in the sense that it prohibits the user from booting an application from a hard disk without having to insert a key disk each time. He is also critical of Apple's decision not to make more information about its ROM-based operating system available for the Macintosh.

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Personal computer hardware designers are constantly confronted with the task of squeezing increased performance from limiting standards. Particularly in the area of mass storage, personal computers are bumping up against I/O (input/output) bottlenecks imposed by existing floppy-disk and

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REVIEW FEEDBACK

implements exceptions and exception handlers, including those on blocks and packages.

Last, the prices mentioned in the article changed at the beginning of 1985. We no longer directly sell the CP/M version of Janus/Ada, but it is still available through Workman & Associates (112 Marion Ave., Suite 3B, Pasadena, CA 91106, (818) 796-4401). The C-Pak (the compiler, linker, and Ada-standard libraries), which is mainly intended for education, is available for \$99.95. The D-Pak, which includes the C-Pak, the tools, and the full set of libraries, is now priced at \$900. The S-Pak, which includes the D-Pak, our Pastran Pascal-to-Ada translator, and the source code to the libraries, is \$1500. The D- and S-Paks are intended for software development.

RANDALL L. BRUKARDT
RR Software Inc.
Madison, WI

I am glad that RR Software has updated its compiler to handle Ada's current syntax. My impression as I finished the review was that the new version had not yet been released. I will be pleased to update the review when RR loans me the compiler's new version; they have promised to do so.

Mr. Brukardt is correct about `get_line`. Ada does not have a single-parameter `get_line` procedure (`get_line` also returns a natural integer for the length of the string). My intent was to point out that `get_line` had not been implemented as a procedure, something that has presumably been fixed in the new version.

Regarding BYTE benchmarks, I used the standard BYTE Sieve of Eratosthenes prime-number benchmark in Ada (January 1983, page 288); BYTE does not normally review the performance of optional optimizers or of rewritten benchmark programs, since these defeat the purpose of benchmarks. If the optimizer is now a standard component of Janus/Ada, an updated review should include its performance. Anyone who can suggest a better compiler benchmark that can be fairly translated across all languages should let me know.

I realize that Ada does not have an unsigned integer type. My point was that you cannot run the Fibonacci benchmark in Janus/Ada because the language cannot handle numbers that large without overflowing the stack or heap. I wasn't faulting the compiler or language as much as explaining why I couldn't pro-

vide a value for this standard benchmark. Since the maximum and minimum values for integer are not specified in the reference manual, other Ada compilers might be able to execute this benchmark.

I am happy to hear that the compiler's price is now \$99.95. If, as Mr. Brukardt reports, the compiler now matches standard Ada 1983 syntax, Janus/Ada is a bargain and a must for hobbyists trying to learn Ada.

—MARK J. WELCH
Staff Writer

ALTOS 586

I agree with Greg Corson's review of the Altos 586 with the XENIX Development System (March, page 247). However, we have managed to circumvent some of the problems he mentions.

We are using two Altos 986-40s with Altos Worknet, 10 terminals, two high-speed printers, two modems, and six local screen printers. The modem communication problem was solved by purchasing M-Link. This communication program lets us control communication protocol rather than rely on the standard Altos output.

The XENIX Development System is amazing; much like CP/M, you understand XENIX from other authors' articles and books, not from the original documentation. However, we are using programs written in COBOL, FORTRAN, C, and MS-BASIC interchangeably and without knowing which program is written in what language.

With the advent of XENIX 3.0 and Worknet 3.0, the documentation is now in 13 manuals covering 20 inches of shelf space. Both the hardware and the XENIX system are superior, but liaison between hardware and software becomes extremely confusing.

RICHARD C. LOFBERG
Teaneck, NJ

ATARI 800XL

I was pleased to see Jon Edwards's review of the Atari 800XL (March, page 267). The 800XL is a superior machine for the money. For \$300, a computerist can get a disk drive and a 64K-byte 6502C machine.

Literally thousands of programs are available for the Atari, and two magazines devoted entirely to the machine do an outstanding job.

Also, the Action! compiler works faster than any I have seen, and it produces good, tight machine code. It is highly structured, complete with subroutines,

(continued)

REVIEW FEEDBACK

global variables, local variables, and arguments. I wish someone would tell computer teachers in elementary schools how cheaply they could teach structured programming instead of BASIC.

J. RAY WOOD
Benton, IL

JUKI'S TRACTOR FEED

John J. Williams's letter in Review Feedback (March, page 303) found sympathetic readers: We experienced the same difficulty with the tractor feed. Since we have four Juki printers, we felt we had bought into a lemon factory until we hit on what appears to be an inexpensive solution.

The paper path from the underside of the tractor, around the platen, and back again through the top is too long and allows for paper slippage. This isn't too bad unless you need some form of double-printing. We finally found a method to take up the slack that gets rid of the wandering without causing gear-stripping friction.

The steel rod just below the paper-out bail is mounted to each end plate. We could remove only the left screw, but this was enough to access one side of the rod. We took polyethylene spiral wrap for harnessing cables and worked it on over the steel rod. The size we used was $\frac{3}{8}$ inch outside diameter, but $\frac{1}{2}$ inch would probably be easier to work with. A light touch of silicon lubricant helped it slide more easily, and any residue that made it to the outer surface of the wrap probably reduced the paper friction.

This slight addition to paper-path length worked wonders for us. The spiral wrap should be available locally, but several electronics mail-order catalogs carry it too.

JOHN J. NEVILLE
Onamia, MN

TECMAR'S JRCAPTAIN

In Glenn Hartwig's review of jrCaptain (March, page 299), he remarked about the cosmetics of the keyboard, the limitations of a single disk drive, and the need for more memory. In home use, I have found none of these problems insurmountable.

When you spend a lot of time with a PCjr, you find two less obvious problems, one major and one relatively minor. The minor one is the limited keyboard buffer. The serious problem is lack of direct-memory access (DMA): Everything stops when you read or write to disk. Almost every PCjr owner I meet has problems downloading files from remote host computers. There is a crying need for software that will support flow control for receiving

ASCII files, as well as XMODEM for binary files.

I assume that expansion units like Tecmar's do not provide DMA but do get around these problems by providing a virtual disk in RAM. Are reliable file transfers possible this way? Is that also possible without the memory expansion? In other words, is there a RAM-disk program that is compact and will fit 40K or 50K bytes of storage into the PCjr above the communications program?

P. M. MORETTI
Stillwater, OK

Perhaps other PCjr owners can offer suggestions.

—GLENN HARTWIG
Technical Editor, Reviews

Glenn Hartwig could not find the data sheet for an 8314 memory chip on Tecmar's jrCaptain because it does not exist. The number 8314 is a date code representing the 14th week of 1983 when the part was manufactured. Almost all semiconductors are branded by the manufacturer with its logo, a part number, and a date code for lot traceability. Off-brand or retested parts will have the manufacturer's logo obliterated or removed but will generally leave a generic part number such as 4164 and the date code.

DAVID W. THOMSON
Highlands Ranch, CO

MICROSOFT BASIC

Manly W. Mumford, commenting on Microsoft BASIC in Review Feedback (March, page 303), made the same observation my students do at first: It seems crude compared to BASICs on lap and home computers because it lacks a full-screen editor and a Clear Screen statement.

The problem is that MS-DOS and CP/M provide software with only a simple service to print ASCII characters to the screen. When Microsoft designed MBASIC to run, without changes, on any computer (that is, working strictly through the system), this limited cursor movements to the directions provided by ASCII or the system. Since ASCII was designed around Teletype terminals using paper, text display can proceed only to the right and down except for backspacing along the current line. This rules out the possibility of a full-screen editor.

For similar reasons, ASCII, MS-DOS, and CP/M do not provide for clearing the screen. To provide these services to soft-

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ASK BYTE

issue of Creative Computing for more details.

It is not possible to call a compiled BASIC program as a subroutine from a noncompiled BASIC program.—Steve

CHAMELEON PLUS POWER SUPPLY

Dear Steve,

In his review of the Chameleon Plus (June 1984, page 327), Rich Krajewski stated that the Chameleon has a switching power supply and that it could be switched only by a dealer. Is there any way to switch it myself?

Also, do the Chameleon Plus, Compaq, and the Panasonic Sr. Partner run Microsoft's Flight Simulator?

DAVID TAY
McLean, VA

When you speak of "switching" the power supply in the Chameleon Plus, I assume you are referring to the review article's mention of being able to switch between 110 V and 220 V. Although I have not seen the power supply in the Chameleon myself, most power supplies of this type do have a simple switch, appropriately marked, for changing between the two voltages. I am assuming that this switch is located within the power-supply box in the Chameleon. If you are the experimenting type, you can remove the power supply from the Chameleon, take the cover off of the supply, and look for a switch marked something like "110-120 V, 50-60 cycle" on one side and "220-240 V, 50-60 cycle" on the other. If you do not find such a switch, do take it to your dealer.

I have personally tested Flight Simulator on the Chameleon and it does not work. Published reports state that it does work on both the Compaq and the Sr. Partner.—Steve

ATARI NUMBER CRUNCHING

Dear Steve,

I have been doing a certain amount of scientific computing on the 6502-based Atari 400 and 800XL computers. The main advantage of these machines is that interactive graphics is easy and nice, but there is a problem with speed as the BASIC and the floating-point hardware are pretty slow. Accessing the floating-point routines with machine language seems to speed things up by only about 40 percent.

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at most, and is clumsy.

Is it possible to speed things up by replacing the 6502 chip with the new 65816 in the Ataris, or would something much more extensive be necessary?

Also, I remember seeing an ad for the Fastchip, a faster replacement for the floating-point hardware chip for the Atari. That was a year or so ago. Are they still available, and do you know where I might get a couple?

JOHN COCKE
Tucson, AZ

Replacing your 6502 with a faster chip is possible, but several hardware and firmware changes are required that make it uneconomical.

A less expensive approach is to use the Fastchip. This chip will speed up applications involving floating-point calculations by as much as four times, according to the manufacturer. A review of the Fastchip appeared in the September 1982 issue of Compute! magazine. The Fastchip is available from Newell Industries, 3340 Nottingham Lane, Plano, TX 75074.

—Steve ■

Between Circuit Cellar Feedback, personal questions, and Ask BYTE, I receive hundreds of letters each month. As you might have noticed, at the end of Ask BYTE I have listed my own paid staff. We answer many more letters than you see published, and it often takes a lot of research.

If you would like to share the knowledge you have on microcomputer hardware with other BYTE readers, joining the Circuit Cellar/Ask BYTE staff would give you the opportunity. We're looking for additional researchers to answer letters and gather Circuit Cellar project material.

If you're interested, let us hear from you. Send a short letter describing your areas of interest and qualifications to Steve Ciarcia, POB 582, Glastonbury, CT 06033.

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Four for Color Computer

Computerware has released four programs for the TRS-80 Color Computer.

The OS-9 Macro Conditional Assembler, or Mac, produces OS-9 modules and supports standard 6809 assembler mnemonics and directives. It can handle conditional assembly, repeat sequences, and inclusion of source library files. All Mac source files are compatible

with those produced by the Microware assembler. Mac requires OS-9 and 64K bytes of memory. It costs \$49.95.

The OS-9 Text Formatter interfaces with any editor that produces standard ASCII text files. It's also NROFF-compatible. Among its features are centering, page numbering, and dynamic dates. The formatter requires 64K bytes of RAM and OS-9 and costs \$34.95.

For development under OS-9, Computerware offers CBUG, a screen-oriented debugger with a disassembler, single-step capabilities, memory window, and access to the OS-9 shell. It also has a built-in hexadecimal calculator. CBUG, which sells for \$39.95, requires 64K bytes of RAM and OS-9.

Color Connection III is a communications package that works with Hayes and Radio Shack modems. It incorporates CompuServe's Protocol B, XMODEM protocols that download directly to and from disk, and an automatic XON/XOFF protocol that downloads directly to disk. The price is \$49.95. At least 32K bytes of RAM is necessary.

When you order any of these packages, add \$2 to the cost for shipping. Contact Computerware, POB 668, Encinitas, CA 92024, (619) 436-3512. Inquiry 641.

Atari EEPROM/EPROM Programmer

Designed to convert an Atari into a development tool, the Proburner can be used to program EPROM types 2716 through 27128 (plus the 2532) and a variety of 2K-byte through 8K-byte EEPROMS. The cartridge plugs into the slot of the Atari 400/800 and XL/XE series.

Among the functions the Proburner provides are copy, erase check, verify, and burn in. Binary files can be stored or loaded to disk or cassette. You can call a monitor for memory display and changes, block moves, and printer dumps. The unit can also run chips from its socket. Because Proburner offers electronic configuration for each EPROM type, you don't need adapters or switches.

Proburner costs \$149. Contact Thompson Electronics Ltd., Suite 502, 7 Jackes Ave., Toronto, Ontario M4T 1E3, Canada, (416) 960-1089. Inquiry 642.

Widen Your Screen

You can enlarge the 40-column LCD screens of the Tandy Model 100 and the NEC PC-8201 with TView 80. The software transforms a 40-column screen into a movable 60-column window on an 80-column display.

TView 80 can use the machines' text-processor and telecommunications programs. You can adjust word wrapping to any width up to 80 columns. The package has a suggested retail price of \$39.95 and comes with a utility that keeps track of file sizes and manages memory. It's available at Radio Shack stores or from Traveling Software Inc., 11050 Fifth Ave. NE, Seattle, WA 98125, (206) 367-8090. Inquiry 643.

Improvising Commodore

Cantus, a music program for the Commodore 64, improvises its own tunes based on your input. Instead of typing notes, you enter choices for tempo, harmony, rhythm, counterpoint, voice range, and tone color. Cantus uses these selections to create, in real time, its three-voice improvisations.

Each set of choices becomes a patch. The software comes with more than 65 patches representing a variety of musical styles. You can modify and store any patch while Cantus is performing. A graphic display shows the notes as they play.

Cantus was created by Michael Riesman, a composer and performer who has worked as musical director of the Philip Glass Ensemble.

No musical knowledge is required to operate the program, but you do need a Commodore and \$54 (plus \$2 shipping). Contact Algo-Rhythm Software, 176 Mineola Blvd., Mineola, NY 11501, (800) 645-4441; in New York, (516) 294-7590. Inquiry 644.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, 425 Battery St., San Francisco, CA 94111.

THE QUARTER-MEG ATARI 800XL

BY CLAUS BUCHHOLZ

*Upgrade your 8-bit microprocessor to 256K bytes
and add a RAM disk*

IT'S GETTING HARDER to find a microcomputer with less than 64K bytes of RAM (random-access read/write memory). A couple of years ago, the cost per bit of the 64K-bit RAM fell below its predecessor, the 16K-bit dynamic RAM, and the 64K-byte address space supplied by eight of the 64K-bit chips is ideal for the most common 8-bit microprocessors. Now, however, the cost per bit of the 256K-bit dynamic RAM is the lowest, and it is already common in powerful 16- and 32-bit microcomputer systems.

Since eight of these chips provide one-quarter of a megabyte and since they are so similar to their ancestors, it is tempting to upgrade an inexpensive 64K-byte micro to 256K bytes. Obviously, you can't fit 256K bytes of memory into the 64K-byte address space of a 6502 or Z80 all at once, but you can break it up into manageable chunks, called banks, and allow the processor to see one bank at a time. This method of interfacing RAM, called bank selection, requires some new hardware and software support.

This article describes the upgrade and presents a RAM-disk controller for the Atari 800XL. However, you can apply the basic idea to any micro that

uses 64K-bit RAMs—the Apple IIe, the Commodore 64, the MSX machines, and others.

THE ATARI 800XL

The 800XL is a modern version of the popular Atari 800. [Editor's note: See Jon Edwards's "Atari 800XL" system review, March BYTE, page 267.] Introduced in 1979, the 800 was the first machine to use VLSI (very-large-scale integration) technology to bring advanced graphics and sound capabilities into the low-price market. It was also the first to include a full operating system in ROM (read-only memory) to support the versatile hardware. RAM consisted of up to three 16K-byte modules, each constructed around eight 16K-bit dynamic RAM chips.

In the 800, the 6502 processor shares the system with a programmable video DMA (direct memory access) controller, which halts the 6502 for one cycle of the 1.8-MHz clock when it needs to access a byte of screen memory. The 800XL incorporates the same VLSI hardware with newer, higher-density RAM and ROM. One 16K-byte ROM holds the entire operating system, and another 8K-byte ROM contains the BASIC lan-

guage. The RAM consists of eight 64K-bit dynamic RAM chips. Under BASIC, 40K bytes of RAM are usable. The ROMs, which occupy high memory space, can be disabled to gain access to the remaining RAM. The new design is smaller, cheaper, less power-hungry, and more attractive. The Atari is unquestionably a very fine machine.

THE DYNAMIC RAM

The industry-standard dynamic RAM chip is itself an example of superb design. It is small, dense, adequately fast, and cheap. In the last decade, its memory capacity has doubled eight times without the chip outgrowing its 16-pin IC (integrated circuit) package. Each chip inputs or outputs one bit at a time, so each bit has a unique address.

For the 256K-bit chip, the address requires 18 bits. The chip has nine address inputs, each of which does

(continued)

Claus Buchholz (201C East Edgewood, Lansing, MI 48910) is a programmer for Meridian Instruments. He has a B.S. in astrophysics and computer science from Michigan State University. He uses an Atari 800 with a homebrew 192K-byte RAM and an ATR-8000.

double duty. During the first part of a memory access, half of the address bits are presented to the chip. This half is called the *row address*. Later in the access cycle, the chip receives the other half of the address, called the *column address*. The storage cells in the chip lie in a matrix, and the cell being addressed lies at the intersection of the row and column specified. To complete the access cycle, the chip reads or writes the selected bit.

The 800XL uses 64K-bit RAM chips, which have eight address inputs for an 8-bit row address and an 8-bit column address. This is fine for the 16-bit addresses the 6502 supplies. There are eight chips, and each contributes one bit to each byte of RAM.

The 256K-bit RAM is practically identical to the 64K-bit RAM except that it has one extra pin, #1 on the chip, to accommodate the two additional address bits it needs. Pin #1 on the 64K-bit chip has no function. The functions of all the other pins on both chips are identical. Therefore, our upgrade involves unplugging the eight 64K-bit RAMs and placing eight 256K-bit chips in their place. We must also add some circuitry to provide two extra address bits for pin #1.

The storage cells in dynamic RAM chips are actually microscopic capacitors, storing an amount of electric charge that represents a 0 or 1 bit. Since capacitors leak charge, they must be periodically recharged or refreshed. The chip refreshes one or two entire rows when accessed. Every row must be accessed frequently to keep the stored data accurate, but

normal operation of RAM can't guarantee that. The computer system must therefore provide special access cycles called *refresh cycles*, dummy read cycles in which refresh addresses are used as row addresses.

The 16K- and 64K-bit RAMs require 7-bit refresh addresses. The computer must provide all 128 possible refresh addresses every few thousandths of a second to keep the RAM refreshed. In the Atari, the video controller, which provides refresh cycles in addition to its screen-memory accesses, automatically provides 7 bits for the refresh address. The Atari, in fact, spends 8 percent of its time refreshing RAM.

One snag in designing the 256K-byte upgrade is that standard 256K-bit RAMs require an 8-bit refresh address. Older versions of the Atari video-controller chip provide only 7 bits of refresh address; newer versions provide all 8 bits. Therefore, I have designed two versions of the upgrade's interface circuit. The more complex one must add another bit to the Atari's refresh address. (See table 1 for a list of components.)

BANK SELECTION

To fit 256K bytes into the 6502's 64K-byte memory space, you must divide it into banks. The upgrade uses eight 32K-byte banks, numbered 0 through 7 and selected by setting 3 bits in the Atari's memory-control register. Any one bank can appear in the lower half of the 6502's memory space. At power-up, bank #7 appears in the lower 32K bytes of RAM, bank #6 ap-

pears in the top 32K bytes, and the Atari acts as a normal 64K-byte machine. To access bytes in the other 192K, a program must select one of banks #0 through #5, which would then appear in place of bank #7. After accessing the bytes, the program could then switch bank #7 back in, restoring the normal configuration.

I used eight 32K-byte banks instead of four 64K-byte banks for three reasons. If a program in RAM were to replace the entire 64K bytes of RAM with another bank, it would cause itself to disappear, crashing the system. Moreover, the top 32K bytes of the address space is already cluttered with hardware addresses and ROMs that can be switched in and out. Finally, the screen RAM is usually in the top 32K; switching it out would cause glitches to appear on the screen.

Even with eight 32K-byte banks, we must be cautious. The operating system keeps important data in the lower part of RAM, and it expects the data to be there. Worse, interrupts frequently invoke routines that keep data in low RAM. Programs must therefore follow a strict rule: Keep bank #7 enabled as much as possible. If you select another bank, you must first disable all interrupts and not call the operating system until bank #7 is restored. One further consideration involves the 6502's stack, which is in low memory. The program should not use the stack when bank #7 is not selected, unless it takes great care to keep the stack valid.

INTERFACING THE RAM

Figure 1 is a schematic diagram of the interface circuit for the 256K-byte RAM. It must be assembled on a small circuit board and installed inside the computer because the computer's expansion slot doesn't carry the signals we need. The circuit consists of two chips and replaces one of the chips on the motherboard. It also requires four jumper wires to various points on the motherboard.

The circuit plugs into the socket at position U27 on the motherboard. This gives it access to six important

(continued)

Table 1: The components you'll need to upgrade the Atari 800XL.

Quantity	Part Number	Description
8	41256	256K-bit dynamic RAM (200 ns or faster)
1	—	33-ohm, 1/4-watt resistor
(following part for circuit in figure 1 only)		
1	74LS153	Dual 4-to-1 multiplexer
(following parts for circuit in figure 2 only)		
1	74LS151	8-to-1 multiplexer
1	74LS393	Dual 4-bit counter
1	74LS00	Quad NAND gate

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QUARTER-MEG ATARI

signals, including power and ground. The chip that was at U27 becomes IC1 in the circuit. As U27, this chip was one of the two responsible for selecting which 8 of the 16 address bits were passed to the 64K-bit RAMs at one time.

IC2 performs the bank selection by modifying one of the eight original address inputs to the RAMs and adding a ninth. The bank-selection circuitry needs three jumpers from the motherboard to carry 3 bits from the Atari's memory-control register. A fourth jumper carries the ninth address input to the RAMs.

Figure 2 shows the four-chip interface circuit necessary for machines containing the older version of the video controller. IC3, an 8-bit binary counter that counts the refresh cycles, supplies the eighth bit of the refresh address for the 256K-bit chips. The

refresh signal it uses comes through a jumper wire from the motherboard. Parts of IC1, IC2, and IC4 perform the bank selection in this circuit.

PERFORMING THE UPGRADE

To disassemble the 800XL, remove the six screws on the underside and separate the top and bottom portions of the plastic case. Be careful of the flexible keyboard cable. Pull it straight up out of its socket on the motherboard. To detach the motherboard from the case bottom, remove three screws—one on the right side, one in the right rear corner, and one in the left rear. Gently pull the board free.

Next, remove the small nuts and bolts around the metal shielding that encases the motherboard. On the left side of the exposed motherboard, locate the row of eight 16-pin RAM chips. Just to their right is U27. Behind

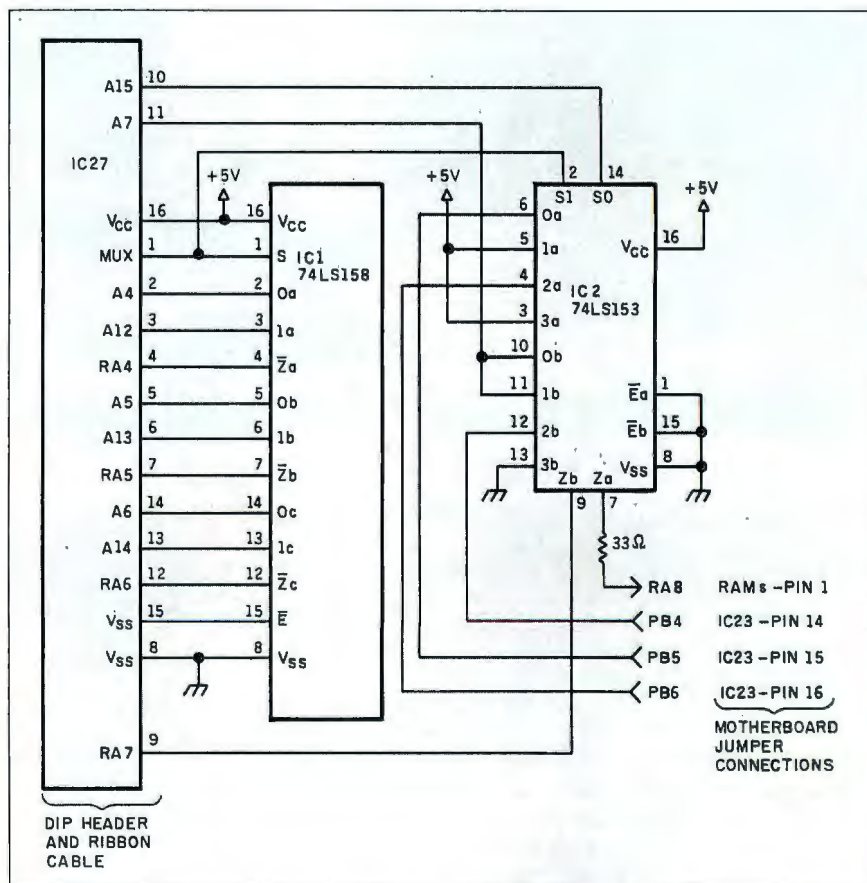


Figure 1: The schematic diagram of the interface circuit for the 256K-byte RAM. Use this circuit if the part number on the video controller is CO21697.

U27 is a 3-inch square area that fits inside the shielding. The circuit goes there because the shielding is highest toward the rear.

Replace the 64K-bit RAMs with the 256K-bit RAM chips. The new RAMs are very easily destroyed by static discharges, so extreme care is necessary in their handling. Lay aluminum foil on the work surface and keep the motherboard, RAM chips, tools, and your hands in contact with the foil at all times. This keeps everything at the same potential, decreasing the possibility of damage.

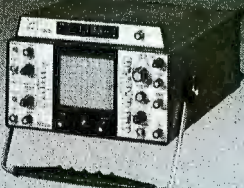
On the motherboard, locate the video controller, the 40-pin chip at U7. If the part number stamped on it reads "CO21697," you can use the simpler circuit shown in figure 1. If the number reads "CO12296," you must use the larger circuit.

Assemble the appropriate circuit on a 2- by 3-inch circuit board (Radio Shack's #276-150 is ideal). Use very low-profile sockets or no sockets at all because the shielding severely limits the height. If you do not use sockets, be careful not to apply heat to the IC pins for too long. Keep the wiring on the chip side of the board to conserve space. The wiring must be soldered because there is no room for wire-wrap posts.

The board plugs into the socket at U27 via a 16-pin DIP header and short ribbon cable. Finally, install the jumper wires. Find a resistor marked R32 immediately behind the row of RAM chips and remove it. A trace from one of the holes runs to pin 1 of the RAMs. Solder the first jumper to that hole. The next three jumpers run to a parallel port that the Atari uses to control ROM switching. We need pins 14 through 16, which are normally unused and not connected to any traces. Locate U23 and carefully pry the 40-pin chip from its socket. Bend up pins 14, 15, and 16 so that they point straight out. Reinsert the chip. Cut three adjacent pin positions from an IC socket and solder the three jumpers to them. Use this custom socket to connect the jumpers to the three protruding pins.

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Cover the connector with electrical tape because the shielding is very low at this point.

If you are using the circuit of figure 2, you must install a fifth jumper. Locate a trace on the motherboard from pin 8 of the video controller, U7. Find a hole along the trace and solder the jumper there. Finally, insert a thin

piece of stiff cardboard or plastic under the small circuit board to avoid shorting the circuit. Refasten the shielding to the motherboard. If it doesn't fit over the circuit, carefully pound a dent out of the shielding with a hammer. Reassemble the computer. If all has gone well, the computer should power up normally and per-

form exactly as before, as long as the 3 bits in the memory-control register are left alone. The computer is ready to try some software that makes use of the large RAM space.

THE RAM-DISK SOFTWARE

Bank-selectable RAM is useless without software to control it. The software must obey strict rules as outlined above to work properly. The software must also be tailored to fit the application.

For example, you could store many graphics screens in the RAM and use page flipping to display them in quick succession for animation. Alternatively, the RAM could act as a print spooler. A word processor could print an entire document quickly into the RAM and go on to other jobs while the RAM emptied its contents slowly to a printer.

A more universal application is the RAM disk, a RAM-based disk-drive simulator. To DOS (disk operating system) and to the user's programs, the RAM disk appears to be just another disk drive, except that it is very fast. Application programs could then use standard DOS commands to access the large RAM space. The 192K bytes of available RAM hold more data than two Atari 810 drives or one double-density drive. I have written an assembly-language program that modifies the Atari's operating system to treat the RAM as either a single-density or double-density disk drive. The program is available for downloading as ATARIRAM.ASM on BYTenet Listings, (617) 861-9774. It works with Atari DOS 2.0, OS/A+ (versions through 2.xx) and compatible DOSes. Assemble the source code with any assembler that accepts the syntax of the Atari Assembler/Editor. Assembly produces an object file that performs several tasks as it loads. First, it copies the operating system from ROM into the underlying RAM. Next, the RAM-disk routines load into the RAM-based operating system, overwriting the international character set, a little-used feature of the 800XL. Finally, it

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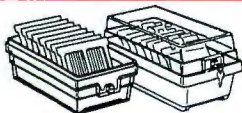
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patches the operating system to install the RAM-disk program and calls DOS's initialization routine to let DOS recognize the new drive.

The source code provides two op-

tions: the drive number and the density. The RAM disk can act as any drive numbered 1 to 8. If you have one real drive, you might want the RAM disk to be drive number 2.

Remember that your DOS must be set up to look for the drive number chosen. See the DOS manual for instructions concerning drive numbers.

Like the Atari 810 disk drive, a single-density RAM disk has 720 sectors of 128 bytes each, for a total of 90K bytes. Like all double-density disk drives for the Atari, a double-density RAM disk has 720 sectors of 256 bytes, for a total capacity of 180K bytes. Atari DOS checks each drive in a system for its density and compensates. All DOS functions except duplicate disk operate with double-density drives. You obviously cannot duplicate a double-density disk to a single-density disk and vice versa.

Boot in the RAM-disk object file after DOS by renaming the object file AUTORUN.SYS. Once the file has loaded, you must format the RAM disk before use. You can do this manually from DOS, use the BASIC XIO command, use a call to CIO in machine code, or rely on an application program.

RESET and warm starts won't harm the contents of the RAM disk. If you reboot without powering down (through a POKE 580,1 and RESET, or by jumping to \$E477 in machine code), you must reload the RAM-disk program to access the data, which will remain unharmed in the RAM disk. The RAM-disk program, therefore, does not automatically format the RAM disk upon loading.

The major disadvantage of the RAM-disk approach is that all data is lost when the computer is turned off. You should therefore be sure to save important data to a real disk before ending. However, the speed, convenience, and versatility of the RAM disk outweigh its drawbacks.

USES

Assembly-language programmers, after studying the RAM-disk source code and heeding the rules above, can devise many practical uses for a quarter-megabyte of RAM. The large RAM space, joined with the Atari's versatile hardware and low price, provides a performance/price ratio that is unbeatable in today's market. ■

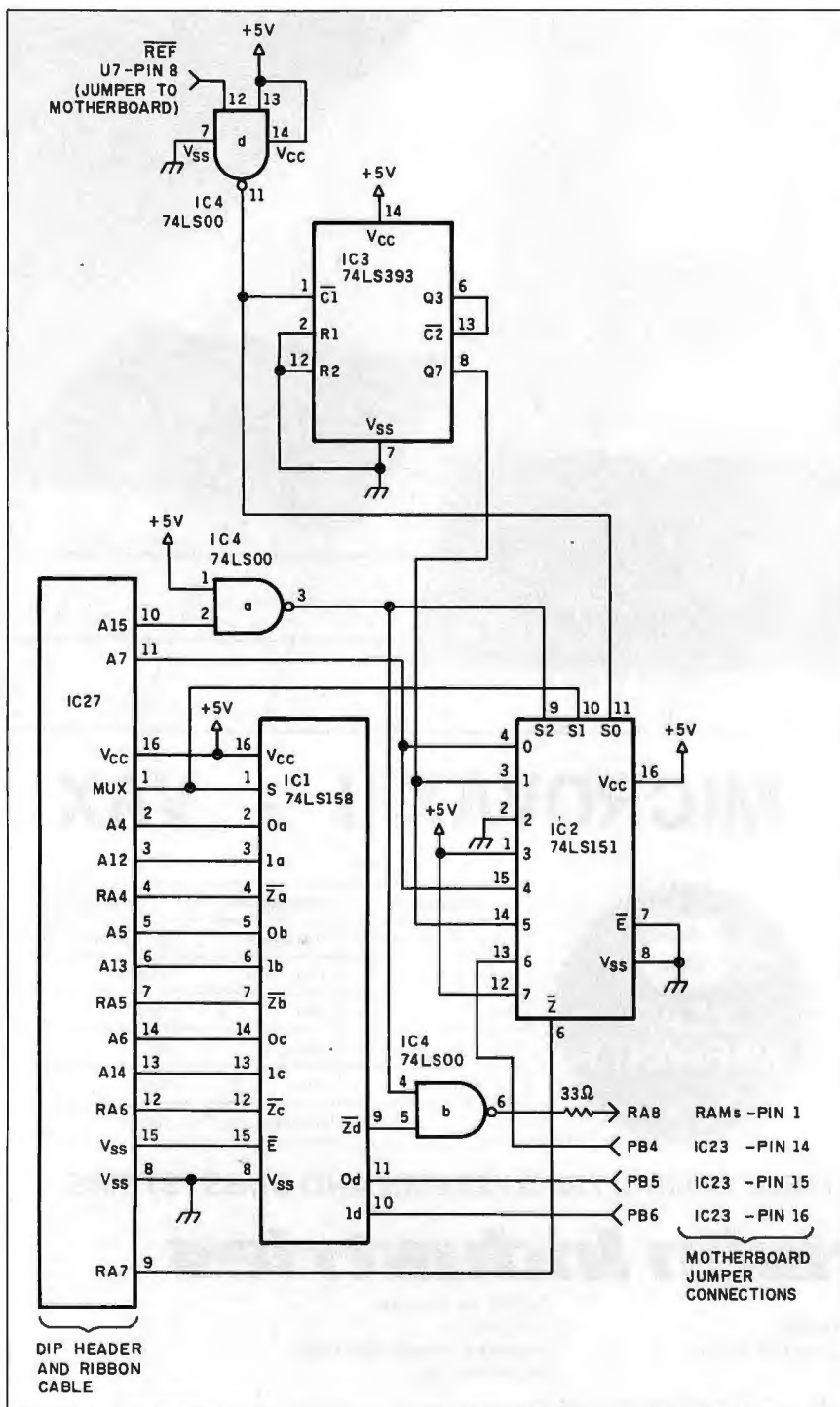


Figure 2: Use this circuit if the video controller part number reads CO12296.

For the IBM PC AT and the AT&T UNIX PC, Rule-Master costs \$5000. A less powerful subset of Rule-Master for the IBM PC XT is \$995. A four-day training session is available at Radian for an additional \$500. Contact Radian Corp., 8501 Mo-Pac Blvd., POB 9948, Austin, TX 78766, (512) 454-4797. **Inquiry 601.**

Aion Corporation is offering the Aion Development System/PC for constructing and using rule-based expert systems on the IBM PC, XT, and AT. The program uses a series of interactive editors and a multiwindow interface to provide a structured programming environment.

The first editor you encounter is the state editor, which works much like an outline processor. It lets you outline your problem, inserting and deleting headings as desired. You can expand or compress the outline or selected portions of it at any time.

When a portion of the outline is fully expanded, you can enter rules relating to it by using the rule editor. The rule-editing screen prompts you for relevant information about the rule. It also finds semantic and syntactic errors.

Although the outline helps you organize a problem, it has no bearing on the order in which the inference engine processes the rules. The program chooses its own path by using a combination of backward and forward chaining, unless you control it by using the step editor to declare sequences. You can also give rules entry conditions to ensure which rule is fired first.

An options window is

always available for querying the system. Through this window you can ask why a question is being asked, how a value was determined, or what the implications of an answer will be. You can also back up and change answers, and you can save sessions and begin them again later where you left off.

The Aion software allows direct access to DOS commands and includes graphics features for custom-designing screens.

The Aion Development System/PC requires an IBM PC, XT, AT, or compatible with 512K bytes of RAM, two disk drives (a hard disk is recommended), and PC-DOS 2.0 or higher. The execution system requires only 320K bytes of RAM. The development and execution software, documentation, and a two-day instruction course for two people costs \$7000. Contact Aion Corp., 101 University Ave., Palo Alto, CA 94301, (415) 328-9595. **Inquiry 602.**

—Brenda McLaughlin

FORTH Development System for Atari's 520ST

The Dragon Group's 4xFORTH is a series of 32-bit FORTH development systems for Atari's 520ST computer. The compiler also includes an assembler and editor and provides full support for multitasking, multi-user access, and file-system access, as well as for RAM disks, serial disks, and printer drivers. Two versions of the compiler are planned. Level 1, available since August at a price of \$99.95, supports Atari's A-line graphics; Level 2, planned for October release at \$149.95, provides support

for the GEM user interface. A \$75 accelerator package enhances the execution speed of code generated by either level compiler.

A complete Developer's System, which includes the Level 2 compiler, accelerator, targetter, and a royalty-free license to distribute programs written with 4xFORTH, is priced at \$500. Complete source code for 4xFORTH is also available for \$2500. You can upgrade any version of 4xFORTH to another by paying the retail price difference plus \$10.

Contact the Dragon Group, 148 Poca Fork Rd., Elkview, WV 25071, (304) 965-5517. **Inquiry 603.**

Ansa's Paradox Database

Ansa Software has introduced its first product, Paradox, a relational database-management program for the IBM PC and 100-percent compatibles. Paradox incorporates some algorithms from the field of artificial intelligence for speed and ease of use.

You pose questions to Paradox by typing an example of the information you want; this is the QBE (query by example) method. Then the two artificial-intelligence concepts—program synthesis and heuristic query optimization—enter the picture. Paradox writes a program (program synthesis) that will produce the answer in the least time (heuristic query optimization). You don't need to know anything

about the data's organization or about the best structure for algorithms.

PAL (Paradox Application Language) comes with the program. This language allows development of applications based on Paradox. Another Paradox function called "scripts" records the series of operations that you perform. You can then play back scripts so they can fulfill much of the use of macros.

Ansa has built Paradox around a rows-and-columns user interface that resembles that of Lotus 1-2-3. Paradox can import or export 1-2-3, Symphony, dBASE II, dBASE III, pfs:File, ASCII, or DIF files.

Paradox works with tables, forms, queries, and reports. Tables can contain up to 260 million characters consisting of 65,000 rows (records), 255 columns (fields), 4000 characters per row, and 255 characters per column. Forms display information about a single record and can be custom-designed. Any change in a form is immediately reflected in the related table. Queries are used to retrieve, select, or perform calculations on the information in tables. The report generator lets you print (to screen or paper) the results of Paradox questions and answers. It can work with both standard and custom-designed report formats.

Paradox requires an IBM or compatible, two floppy-disk drives or one hard disk and one floppy disk, 512K bytes of RAM, and MS-DOS 2.0 or above. Its suggested list price is \$695.

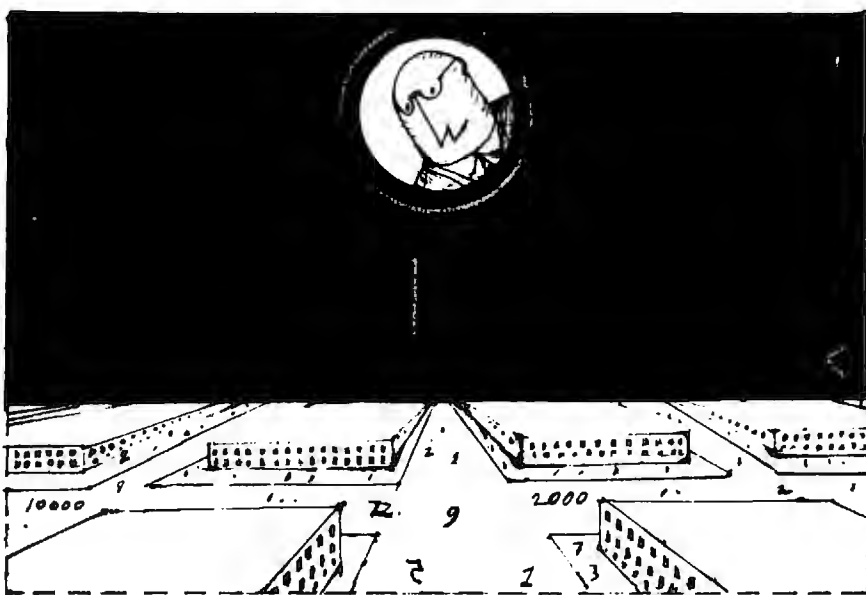
Contact Ansa Software, 1301 Shoreway Rd., Belmont, CA 94022, (415) 595-4469. **Inquiry 604.**

(continued)

The Smartwriter laser printer from QMS Inc. of Mobile, Alabama, has much the same general profile as others built on the Canon engine. Outside dimensions and the configuration of such things as interface connections for most of these units fall pretty much in the same places from vendor to vendor in spite of minor cosmetic differences. You wind up being in danger of thinking they're more alike than they really are.

The Smartwriter seems very capable in the preliminary look we've taken. Aside from a black streak down the long axis of the printed page that may be the result of a defective cartridge, the print quality has been up to usual laser-printer standards. The font selection is as broad as or broader than any we've seen so far. However, a lot of the type styles are actually duplicates. What I mean is, if you want a particular font to print across both the 8½-inch dimension and the 11-inch dimension of a regular letter-size page, you need a copy of that font for each direction.

We ran into problems getting the Smartwriter to change fonts and orientation in its Epson-emulation mode. It would print a status message saying that the font we wanted was installed and ready for use but would obstinately refuse to produce print in any style but the factory-set default font. A call to the company informed us that the printer changes fonts with a lot less trouble if you use its ANSI X3.64-emulation mode for the change-over. I don't think this is the way the machine was designed to operate, since there's no mention of it in the manual. It can cause a lot of frustration until somebody sets you straight, but it's really more of an annoyance than a fatal flaw since it seems fixable with a bare minimum of information.



The documentation is otherwise good. You get lots of step-by-step instructions on which buttons to push and what you're supposed to be seeing in the status window at just about every turn. Additionally, the documentation was complete enough to give me the proper RS-232C pin assignments when I had to make a serial interface cable.

This printer and other representatives of the genre that we now have, or have on order, are going to bear close scrutiny in the months ahead.

Another relatively new arrival here is the Atari 520ST, and since a closer look (eventually a full review) is under development, I'm not going to anticipate the reviewer's comments to any significant degree. The almost total lack of applications software at this point is an obvious drawback, but we'll withhold judgment on that front until and unless Atari and the software developers start to show their wares. At the very least, however, putting almost completely naked hardware out in front of the public would seem to indicate that the company has a fairly high degree of faith in its users' curiosity and enthusiasm.

The GEM screen interface, graphics, and mouse are familiar elements to a fairly broad community by this time. The user interface seems to be through the mouse or the cursor-control keys. A good deal of thought seems to have gone into making the machine as fast as possible in responding to the user. You're not stuck in limbo while the machine grinds away, and you don't waste a great deal of time and energy in impatient fidgeting.

The keyboard has a full-feature design with cursor keys, numeric pad, and 10 function keys. Individual keys provide a greater-than-normal degree of resistance—requiring a harder-than-normal push for touch-typists. The external 3½-inch floppy-disk drive is quiet and, like the system itself, provides very fast response times. The 520ST lets you eject a disk at any point and has an ejection button on the front of the drive for that purpose. All in all, the 520ST has the look of a good machine. At the current low prices from both the manufacturer and the retailers, this computer could arouse significant interest at many levels.

—Glenn Hartwig, Technical Editor, Reviews

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WOW! WOW! WOW!

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11/85

ACCORDING TO WEBSTER

had non-Apple RAM upgrades. Well, since those administrative changes at Apple, the policy appears to be undergoing a reversal, and there may be a good chance that Apple will do what it can to make the upgrade available to all Mac owners. Of course, it looks like the ROM upgrade won't be made available until this coming January, and possibly not even then. Of course, I got my 2-megabyte upgrade before hearing about this, but it is nice to know that I may be able to get the new ROMs anyway.

UPDATE: AMIGA AND ATARI

The next generation of 68000-based systems is hitting the market. Commodore officially unveiled the Amiga at a press conference in New York that was very ritzy, with lots of expensive food and famous people. One of the BYTE editors who attended said it was the kind of introduction that is usually given to cover up a mediocre product. What was amazing, he reported, was that the Amiga was the most impressive part of the introduction.

It looks like the Amiga will hit the market at a price of \$1295 for a 256K-byte machine. That is too little RAM, but the upgrade to 512K bytes costs only \$200 and can be installed in a few seconds; you just plug a cartridge into the front of the machine. A smart move, and another lesson learned from Apple's mistakes. Even so, you'll probably want to add even more RAM to your system. Luckily, Tecmar has announced the T-card, a slim box that plugs into the expansion bus on the side of the Amiga.

The T-card (estimated cost of \$300 to \$500) can hold up to 1 megabyte of RAM. Also, it has a clock/calendar chip and serial and parallel/SCSI (small computer standard interface) ports on the back. These, of course, let you plug in the Tecmar 20-megabyte hard disk (about \$1000) and the Tecmar 300/1200/2400-bps modem (about \$500 to \$700) without tying up any of the Amiga's ports. You can plug together multiple Tcards, giving up to 8 megabytes of RAM (in addition to the 512K bytes inside the Amiga) and a whole lot of ports and clocks in the process. In fact, Tecmar ought to come out with another model of the T-card without the ports and clocks and holding more RAM (2 to 3 megabytes). Tecmar says that all these products (along with a 20-megabyte tape backup unit for less than \$700) will ship "when the Amiga does."

This is all nice, but I still don't have my hands on an Amiga yet. Maybe by next column. In the meantime, I'll try to control my enthusiasm until I can really use one.

One firm that has no enthusiasm about the Amiga is Atari, which is finally starting to ship the 520ST, after missing several "firm" deadlines. I hope to get an ST soon and put it through its paces, doing some head-to-head comparisons with the Mac and the Amiga.

THE GOLDEN TRIANGLE

I harp on memory size a lot, but I am continually amazed at the lack of foresight shown by computer designers. A computer system has to correctly balance three areas: pro-

(continued)

PERIPHERALS

HabaDisk for Atari ST

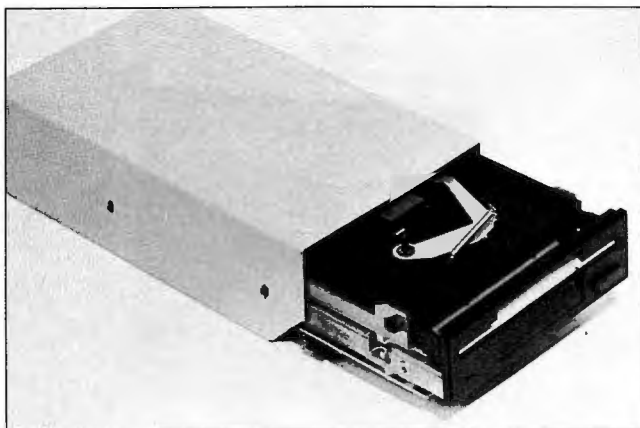
Haba Systems' HabaDisk is a 10-megabyte hard-disk expansion for Atari's ST computer, storing as much information as 12 double-sided disks. The HabaDisk includes its own power supply and an interface cable that attaches to the ST's hard-disk port. Haba says the drive is fully compatible with existing Atari ST hardware and software.

The HabaDisk is priced at \$699.95. For more information, contact Haba Systems, 6711 Valjean Ave., Van Nuys, CA 91406, (818) 901-8828. Inquiry 615.

9-track Tape Drive for IBM PC

The AN-9800-PC from Acknowledge is a 9-track tape subsystem for the IBM PC and Wang Professional computers. The tape drive allows data to be written to and read from the standard 1/2-inch tape on 7-inch reels used by many mainframe and minicomputer makers, permitting data transfer between microcomputers and mainframes.

Included with the self-loading, self-threading AN-9800-PC is a controller card that occupies a single expansion slot in the IBM PC or Wang PC. The 30-pound drive has a footprint of 9 by 14 inches. The IBM PC-compatible tape-drive system is priced at \$4995, while the Wang PC version is \$5995. An optional carrying case for the tape drive is \$145. Contact Acknowledge Inc., 100 Pennsylvania Ave., Framingham, MA 01701, (617) 620-8843. Inquiry 616.



PKI's SydeWyndr external disk drive.

External Disk Drive for Macintosh

SydeWyndr is a 3 1/2-inch external disk drive for the Apple Macintosh. It accommodates single-sided microfloppy disks with a capacity of 400K bytes, formatted, and has a transfer rate of 489.6K bits per second.

SydeWyndr weighs 3 1/2 pounds and comes with a case and connecting cable for \$350. Contact PKI Inc., 2539 West 237th St. E., Torrance, CA 90505, (213) 539-2123. Inquiry 617.

Citizen Daisy-Wheel, Dot-Matrix Printers

Citizen America has introduced two printers, one a daisy-wheel unit, the other a dot-matrix machine.

The Citizen Premiere 35 uses print wheels compatible with the Diablo 630; it can print at 35 characters per second and has a list price of \$599. The printer also has a low operating

noise level of 55 decibels and comes with an 8K-byte buffer. Other features include interchangeable interface cartridges, proportional spacing (selectable by a front-panel switch), and a 12-month warranty.

The Premiere 35 has a push-style tractor-feed mechanism. An optional dual-bin sheet feeder with envelope-feed capability is available for \$400.

The dot-matrix Citizen 120D prints at 120 cps in draft mode. It has a list price of \$249. You can select compatibility with either the IBM Graphics Printer or the Epson FX-80 by throwing a switch. Other features include a 25-cps correspondence-quality mode (selectable with a front-panel switch), a 4K-byte buffer, and a tractor-feed mechanism.

Contact Citizen America Corp., 2425 Colorado Ave., Santa Monica, CA 90404, (213) 453-0614. Inquiry 618.

GTC Laser Printer

GTC Technologies' Blaser is an 8-page-per-minute laser printer based on Canon's LBP-CX printer

engine. The Blaser emulates the Diablo 630 and NEC Spinwriter printers for text output and the text and graphics images of the IBM Graphics Printer (which was based on Epson's FX-80).

While in the IBM Graphics mode, alphanumeric characters are printed in a Courier font rather than the dot-matrix font, and graphics characters are printed taking advantage of 300-dpi capabilities. Standard graphics are output emulating the Epson's resolution, although additional escape-code sequences enable more advanced graphics features.

Each font includes bold-face, compressed, expanded, superscript, subscript, and combinations of these formats, and all characters can be rotated 90 degrees and printed in landscape mode.

Ten font cartridges are available: American Type-writer, Apollo Proportional, Roman Proportional, Apollo Compressed, Elite, Prestige, Cobra, Courier Italic, Helvetica, and Legal. Each font cartridge is \$99; a four-font cartridge is \$289.

The Blaser includes a switch-selectable serial or parallel interface; both interfaces can be enabled simultaneously using an optional \$499 adapter. A \$699 adapter enables the parallel port plus four additional serial ports. Documents from each computer are buffered in the printer's 64K-byte RAM until earlier tasks are completed.

The Blaser printer has a list price of \$2995. For more information, contact GTC Technologies Inc., 216 West Florence Ave., Inglewood, CA 90301, (213) 673-8422. Inquiry 619.

Features

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THREE BYTE STAFF MEMBERS, Jon Edwards, Phillip Robinson, and Brenda McLaughlin, have put together a preliminary but detailed evaluation of the Atari 520ST. They summarize the hardware of the 520ST as "the 68000 unbounded." Among the features they were impressed with are the quality of video output (though you must choose between monochrome and color), the speed of the disk I/O, and the variety of ports. An unfinished operating system and minimal application software did not dampen their overall impression.

The subject of analog-to-digital conversion is one that Steve Ciarcia returns to every few years. He does this largely so that new readers can learn the basics. For readers who have been around for a while, he also includes the latest conversion interface. This month's column is no exception. Steve discusses the basics and then describes a 16-channel 12-bit high-speed A/D converter.

"Q&A" is a product preview about an integrated software package that combines word processing and file management with a full macro facility and an effective natural-language interface—your Intelligent Assistant. By entering normal English phrases and sentences, you can carry on a conversation with your Assistant and get a lot of information into and out of your database. Jon Edwards provides a sample session in "Q&A," discusses some of its drawbacks, and compares it with other natural-language database products.

Last month, Jonathan Amsterdam began a three-part article on a compiler for his high-level language called SIMPL. This month, he describes the part of the compiler that handles procedures and functions, also known as routines. The routines of SIMPL are similar to those of Pascal, and like most routines, they're useful for programmers but difficult to compile.

Large software projects can be undertaken by simply reusing the same modules of code in different programs. Modula-2 imposes some restrictions to this method, and Namir Clement Shammass, author of "Create Reusable Modules," offers a program strategy as a solution. The strategy involves the creation of capsule editors, the advantages of which include customization of programs, lowered costs, and increased reliability.

Creating three-dimensional graphics on microcomputers has been a popular subject with both BYTE readers and authors. In "Budget 3-D Graphics" (March 1985), author Tom Clune looked at the program SURF, which includes such advantages as hidden-line removal and the ability to rotate the plot around three axes. This month we have "Easy 3-D Graphics" by Henning Mittelbach. The author has written a low-cost, three-dimensional graphics program for the IBM Personal Computer, the Apple Macintosh, and the Apple II family.

THE ATARI 520ST

The 68000 unbounded

Editor's note: The following is a BYTE product description. It is not a review—for several reasons. Some of the equipment we received, such as the hard-disk drive, were prototypes, and at the time of this writing, software is scarce. Atari has not yet completed its BASIC interpreter, and the operating system, TOS, remains unfinished. Nonetheless, we are as intensely interested as our readership in new technology, and we feel we have learned enough to share some of the results of our investigations. We began our work on this description as soon as we were able to get a system from Atari. A full review will follow in a subsequent issue.

For many years the public has equated the Atari name with arcade games and joysticks. In truth, the Atari 400/800/XL computer line is technically at least comparable if not better than other 8-bit machines, so it should not be a surprise that the company's latest venture, the 520ST (see photo 1), is a competitive 68000 system. Indeed, we are most impressed with the clarity of the graphics, with the speed of the disk I/O (input/output), and with the 520ST's value.

The system is not without its problems. The desktop is less effective than the Macintosh's, the keyboard has an awkward feel, and the current operating system makes it impossible to switch between high-resolution monochrome and low- or medium-resolution color without installing the

other monitor and rebooting. Nonetheless, we are left with a very favorable impression; several software-development languages are already available, including FORTH, Modula-2, and C. With them, you can tap the power of the 68000 at a most reasonable price.

SYSTEM DESCRIPTION

The Atari 520ST is a keyboard computer. Like the Commodore 64 and the Atari 400/800, the 520ST keyboard unit contains the microprocessor, the memory, the video and sound circuitry, and so on. The power supply, disk drives, and monitor are external devices. The 520ST has a variety of ports, but there are no internal expansion slots.

The In Brief box on page 90 summarizes the features of the Atari 520ST. For \$799, you get the CPU, a 12-inch diagonal monochrome monitor, and one external single-sided double-density floppy-disk drive. For \$999, you get the same system with a 12-inch RGB analog monitor in place of the monochrome monitor (see photo 1). Both systems provide 512K bytes of RAM (random-access read/write memory), a Motorola 68000 microprocessor, MIDI ports with a transfer rate of 31,250 bps (bits per second), a DMA (direct memory access) port with a transfer rate of 10 megabits per second for a hard disk or CD-ROM (compact-disk read-only memory), and much, much more. To be sure, owners will make some sacrifices. The unit does not have an RF (radio frequency) modulator for television output, every peripheral has a separate power supply (wire haters beware), and the operating system

currently rests in RAM, stealing over 200K bytes from your workspace. We have summarized other problems below, but almost all are insignificant when you consider what you do get for the money. And rest assured, the system works. Our first system, like most of the first production units, had to have several chips reseated. It now functions properly, and we have not heard of any similar quality-control problems on the latest 520STs.

THE HARDWARE DESIGN

The heart of the 520ST is the MC68000, with its 16-bit data bus and 24-bit address bus, running at 8 MHz (see figure 1). The rest of the system was designed to stay out of the 68000's way. (See the 520ST motherboard in photo 2.)

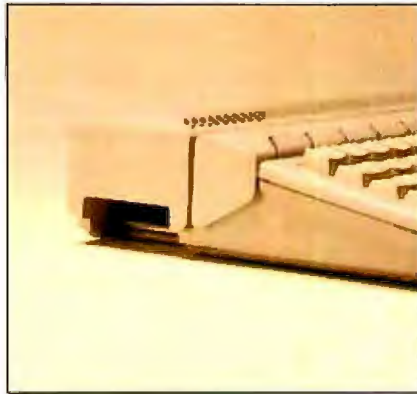
The Atari design team began work on the 520ST in May 1984. From the start, they had several specific goals in mind. The first was to choose a fast microprocessor and do everything to let it run effectively at full speed. To the Atari team, that meant maximizing bus bandwidth and relegating as

(continued)

Jon R. Edwards is a technical editor, Phillip Robinson is a senior technical editor, and Brenda McLaughlin is an associate news editor for BYTE. They can be contacted at BYTE, POB 372, Hancock, NH 03449.



(a)



(b)



(c)



Photo 1: The Atari 520ST, shown here with the color monitor and two single-sided double-density disk drives. (a) On the right side of the keyboard unit are two joystick/mouse ports. (b) On the left is the 128K-byte ROM cartridge port. (c) The rear of the disk drives has specific ports for I/O in and I/O out.

many mundane tasks as possible from the microprocessor to other chips. Second, according to Shiraz Shivji, Atari's vice president for research and development, "We didn't want to reinvent the wheel . . . things that were available that could offload the processor—we wanted to use." A direct result of that goal was the use of several standard chips (such as the Western Digital WD1772 for floppy-disk-drive control) and use of custom

CMOS (complementary metal-oxide semiconductor) chips for performance, reliability, and manufacturability. All four custom chips—Glue, the Memory Controller, the Video Shifter, and the DMA chip—share many of the 520ST's duties.

Third, the 520ST had to provide high-quality color displays. Finally, the design team wanted to give the 520ST excellent I/O capabilities. That goal is reflected in both the variety of ports that

surround the 520ST and in the high speed of the DMA (hard-disk) port.

MEMORY

The 520ST currently includes 512K bytes of RAM and 16K bytes of ROM. The RAM consists of sixteen 256K-bit dynamic RAM chips that are rated at 150 ns (nanoseconds). Atari is already talking about 1-megabyte and 2-megabyte (RAM) versions of this same computer. The 68000 CPU (central processing unit) can directly address up to 16 megabytes of ROM and RAM, but the present Memory Controller chip can only work with 4 megabytes. The circuit board has room, but it will need a slight redesign to use the 1-megabit dynamic RAMs when they become available. (The 1-megabit chips have two more pins than the 16-pin 256K-bit chips they would replace and also would have some of the signals on different pins. This change would require a small modification in manufacturing.)

Memory is configured as five 64K-byte sets of ROM and one configurable bank of 128K bytes, 512K bytes, or 2 megabytes of RAM. (Early in 1985, Atari mentioned a possible 128K-byte RAM version of the ST.) Software determines the ROM configuration. A shadow-test algorithm that loads a Memory Configuration register determines the RAM configuration. When the computer is turned on, this algorithm tries to write to and read from memory addresses unique to the possible configurations.

The memory map is shown in figure 2. The first 2K bytes (lowest address values) are reserved for the exception vector table and the supervisor stack. These 2K bytes—and the I/O space—are protected: They can only be accessed when the CPU is in supervisor mode. Four words of ROM are shadowed at the start of RAM for the reset stack pointer and the program counter.

VIDEO MEMORY

The Atari 520ST offers three display resolutions. The highest resolution is a noninterlaced monochrome 640-by

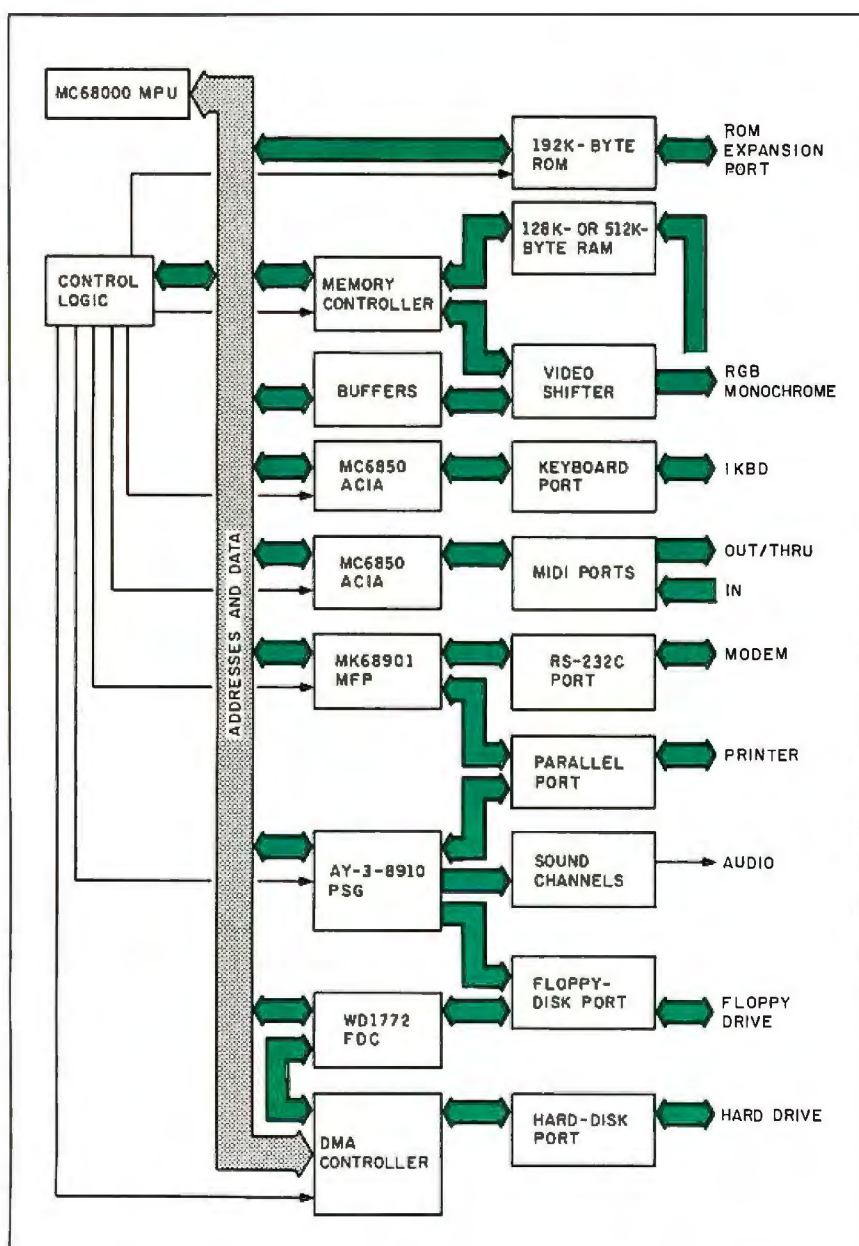


Figure 1: The system block diagram for the Atari 520ST.

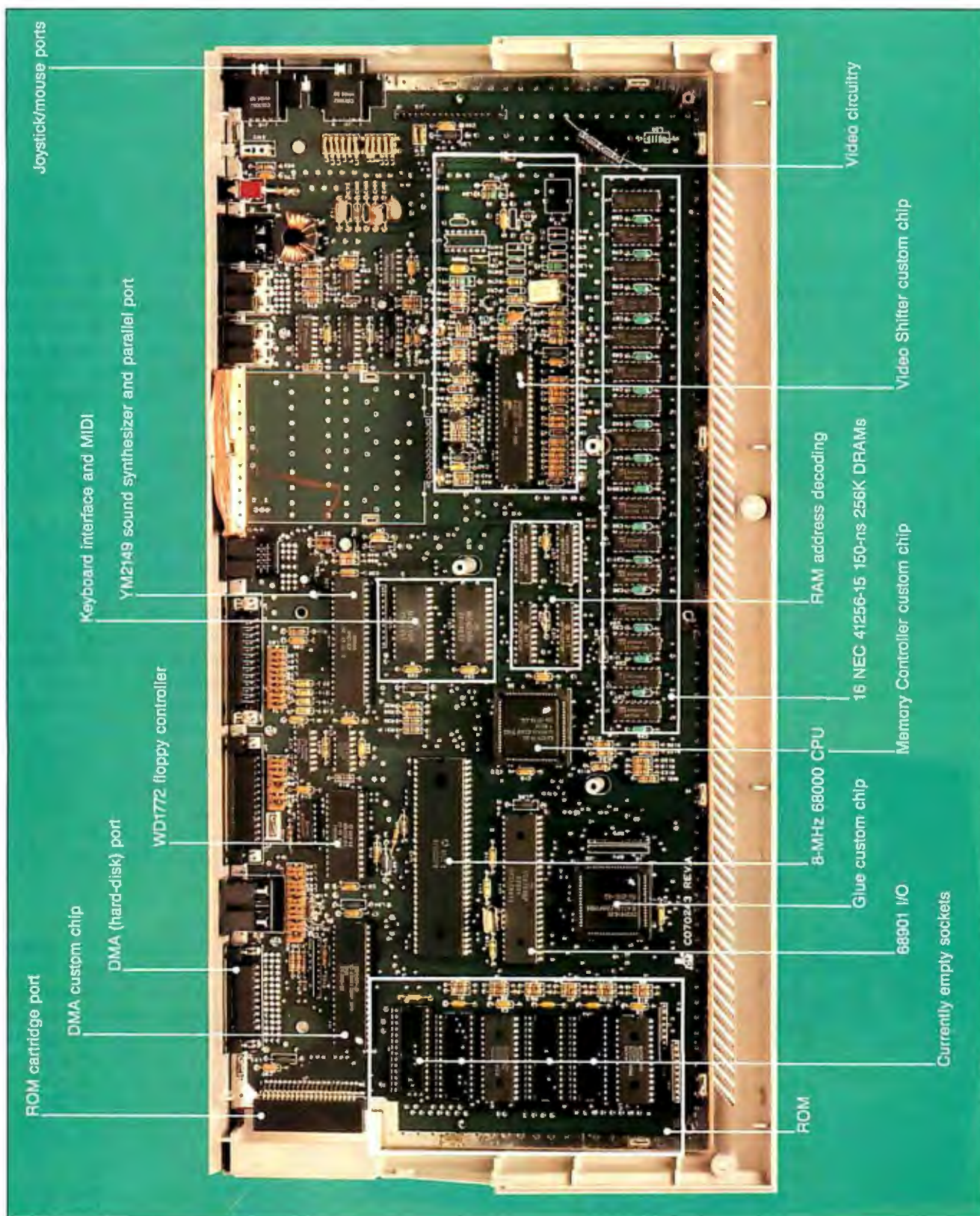


Photo 2: The Atari 520ST motherboard.

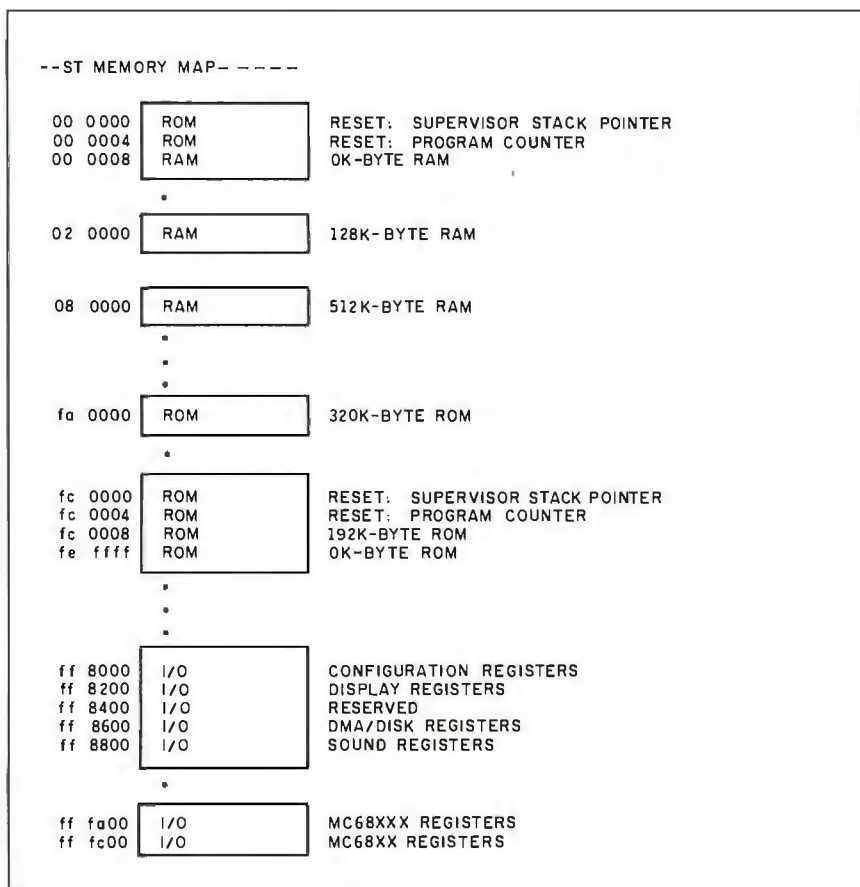


Figure 2: The 520ST memory map.



Photo 3: Low-resolution graphics offer 16 colors in a 320- by 200-pixel array.

400-pixel mode that is output at 70 Hz. The maximum color resolution, "medium resolution," is 640 by 200 pixels with 4 colors (see photo 3). Low-resolution color is 320 by 200 pixels with 16 colors.

Bit maps in the main RAM store all of the displayed images (see figure 3). A special interleaving scheme, managed by the Memory Controller chip, allows the CPU and video to share memory efficiently. Each display mode uses a 32K-byte bit map in memory, each starting at a 256-byte half-page boundary in RAM. This memory is a contiguous chunk configured as n logical planes of 16-bit words. The Video Base Address register holds the starting address of display memory, a value that is loaded into the Video Address Counter register and incremented to determine which plane a word is in.

These registers make video programming straightforward. You choose a mode, select the address for the start of the screen, and then you have a bit-map screen in memory that is affected only by the color palette.

The Video Shifter chip takes words from video-display memory (in general RAM) and combines them according to the mode selected and the position of the word (see figure 4). It then interprets the bits as an index to the color lookup palette. That information is then shifted out to 3-bit digital-to-analog converters that produce the analog RGB (red-green-blue) output.

COLOR PALETTE

The 320- by 200-pixel color resolution uses four planes, the 640 by 200 color resolution uses two planes, and the 640 by 400 monochrome uses one plane. The 16-bit color lookup palette has 9 bits of color per entry, 3 bits each of red, green, and blue aligned on low-nibble boundaries. This arrangement generates eight levels each of red, green, and blue, for a total of 512 possible colors.

The 320 by 200 (four-plane) mode can index all 16 palette colors, but the 640 by 200 (two-plane) mode works with only the first 4 palette entries.

The 640 by 400 monochrome mode bypasses the palette, instead employing an inverter for inverse video. The inverter is controlled by bit 0 of palette color 0. Palette color 0 also assigns a border color in multiplane mode and a white or black border in monochrome mode.

A single call to BIOS (basic input/output system) can change the colors in the palette registers. You could show all 512 colors on a single screen by making such calls on the fly. The 520ST does not have any hardware provision for sprites or player-objects, graphics tools that are found in the Commodore 64, Amiga, and Atari 800. It does have bit-blitting, but only in the GEM software.

MEMORY CONTROLLER

Using the data bus efficiently was an absolute priority in the design of the 520ST. The CPU makes frequent use of the bus: The designers noticed that between 30 and 40 percent of program instructions would be store and load types. And the video display needs constant refreshing from memory. After all, in a bit-mapped system such as this, the display on the screen is virtually an image of what is in the RAM chips.

A 68000 running at 8 MHz takes 500 ns for each memory-access cycle. But during the first 250 ns of that time, it isn't looking at the data bus. Instead, it is just setting up the address bus and performing handshaking functions. Shivji explains that his team decided to use memory chips that could be read in a 250-ns slot, and then to put a Memory Controller custom chip between the CPU and memory. The same controller also sits between the Video Shifter custom chip and memory.

During the first 250 ns of the 68000's 500-ns read cycle, the Memory Controller gives the Video Shifter access to RAM. Then, when the 68000 is ready—during the second 250 ns of the read cycle—the Memory Controller turns RAM access over to the CPU. The Video Shifter and CPU keep taking turns. Because the RAM is twice as fast as the microprocessor,

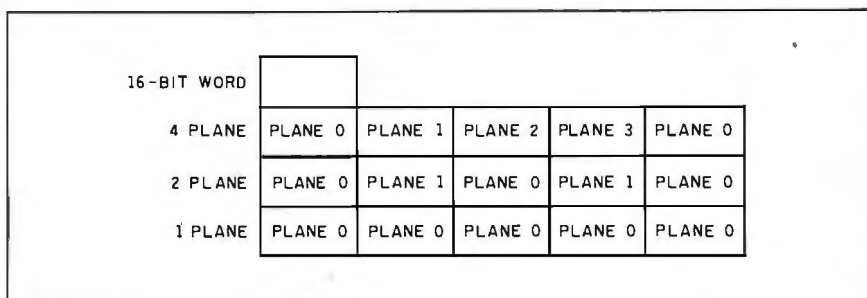


Figure 3: Organization of bit-plane data in memory.

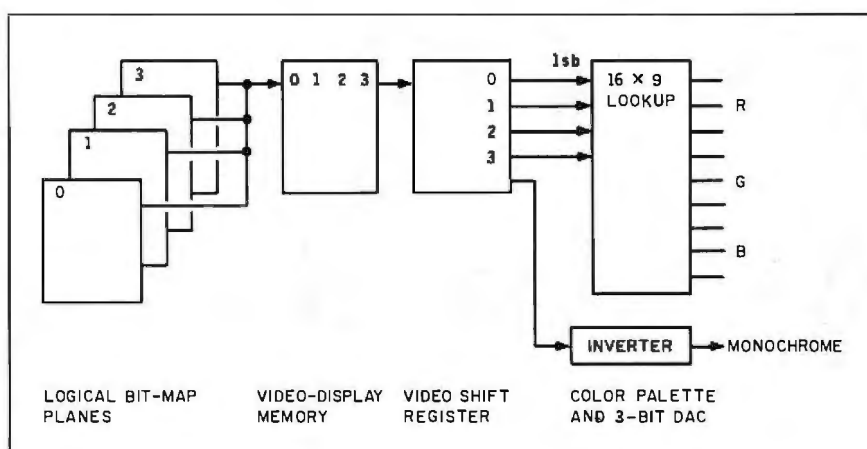


Figure 4: The flow of data from video memory to analog RGB output.

the 68000 can run at full speed and read or write to RAM as it desires without disturbing the refreshing of the display. More important, CPU tasks won't be put on hold while the video circuitry makes heavy demands on memory for high-resolution data.

Occasionally, because the 68000 has an asynchronous bus that you cannot lock exactly with the video circuitry, missed cycles will occur. All that happens is that the CPU has to wait one 250-ns cycle, a rare event according to Shivji.

GLUE

The Glue chip reduces the overall chip count on the board by integrating the functions of many smaller chips into one device. Glue generates chip selects, handles handshaking (for parts that aren't 68000-bus-oriented), and generates both the video timing and the interrupt controls. Although the 68901 handles part of the interrupt management task, Glue takes the

interrupt from the 68901 and determines its priority with respect to the vertical and horizontal interrupts. Glue also handles the actual interrupt acknowledge cycles.

I/O CHIP

The 68901 MFP (multifunction peripheral) chip is a standard member of the 68000 family and provides serial I/O, parallel I/O, timers, and counters. It has eight parallel I/O pins; a 16-source interrupt controller with programmable service modes, including polling and vector generation; four separate timers with individually programmable prescaling; and a single-channel, full-duplex USART (universal synchronous/asynchronous receiver/transmitter).

SOUND

The Yamaha YM2149 sound chip has three independent monophonic voices and uses a 2-MHz clock input

(continued)

IN BRIEF

Name

Atari 520ST

Company

Atari Corp.
1105 Concession Ave.
Sunnyvale, CA 94086
(408) 745-2000

Price

Monochrome system	\$799
Color system	\$999

Microprocessor

Motorola 68000, a 32-/16-bit microprocessor (32-bit internal architecture with 24-bit, nonsegmented, external data bus) running at 8 MHz

Main Memory

512K bytes of dynamic RAM. Expansion to 4 megabytes may be possible in the future through the use of a planned 8-slot expansion interface.

ROM

Current models contain 16K bytes of boot-up ROM. Atari intends to release TOS on ROM for \$20, upgrading ROM to 192K bytes and freeing up that amount of RAM.

Graphics

Three modes: 640- by 400-pixel monochrome, 320 by 200 with 16 colors, and 640 by 200 with 4 colors

Sound

Three independent sound channels from 30 Hz to 125 kHz

Floppy-Disk Drive

Bundled, external 3½-inch single-sided double-density drive with capacity of 360K bytes. System supports maximum of two floppy-disk drives.

Keyboard

94-key Selectric-style QWERTY keyboard with numeric keypad, cursor controls, and rhomboid function keys

Interfaces

MIDI in and MIDI out ports
Monitor port (supports RGB analog, high-resolution monochrome)
Centronics parallel printer port (supports Epson-compatible printers)
RS-232C serial port
Floppy-disk port
Hard-disk port (10-megabit-per-second DMA transfer rate)
128K-byte ROM cartridge port
Ports for mouse or two joysticks

Bundled Software

TOS, including GEM
Atari Logo
BASIC, when completed

Optional Peripherals/Expansion

SF354 single-sided drive	\$199
SF314 double-sided drive	\$299
1-megabyte RAM upgrade (Lemon Micro, Redondo Beach, CA)	\$300

Planned Peripherals

SMM801 dot-matrix printer, SDM121 daisy-wheel printer, 10-megabyte fixed disk, RAM disk for cartridge port, 8-slot expansion interface, local-area network for MIDI port, CD-ROM

to produce tones from 30 Hz up to 125 kHz—more than the human audio range. The chip also has a noise channel. Atari documentation calls this chip the PSG (Programmable Sound Generator). The three channels of output are mixed, converted by a built-in digital-to-analog converter, and sent to a monitor speaker. The designers were also able to use some ports and registers on the PSG for activities completely unrelated to sound generation, such as controlling parts of the parallel and serial ports.

The registers for the voices control a basic square wave while the Noise Generator register controls a frequency-modulated square wave of pseudo-random pulse width. You can mix tones and noise over individual channels by using the Mixer Control register. Amplitude registers allow you to choose fixed or variable (Envelope-register-determined) amplitude.

DMA PORT

The 520ST ports fill the entire back and sides of the keyboard unit (see photo 4). One of the strongest features of the 520ST is the built-in DMA port. Using a CPU to move large blocks of data between memory and external devices is neither fast nor efficient. DMA was created to provide a speedy channel for such transfers and to leave the CPU free to calculate. Without help from the CPU, the Atari's DMA port can move data at 10 megabits per second, a rate twice the standard hard-disk transfer rate and much higher, for example, than the Macintosh, which must make do with a much slower serial port. In addition, the port can handle up to eight daisy-chained devices and is the opening to practical use of CD-ROMs and many other devices.

DMA CONTROLLER

The Memory Controller and Glue custom chips contain parts of the DMA function, but it is the DMA custom chip that directs the high-speed data transfer through the DMA port. The DMA controller and the CPU have equal access to the bus: A

(continued)

first-come, first-served scheme handles contention. Only one DMA operation can take place at a time. A DMA operation depends on the base address, the count, and the read/write status values the program loads into the DMA Base Address and Counter register. In addition, two bits are used as address lines to steer the output of the DMA to the floppy-disk port or to the hard-disk port.

DMA occurs in bursts, with the DMA chip storing information in its 32-byte FIFO (first-in/first-out) buffer

and then sending it in a hurry to either RAM or to the outside world. The DMA chip and the 68000 CPU have equal access to RAM and compete for the same cycles. The DMA chip's 10-megabit-per-second rate is equivalent to 1.25 megabytes per second or 62.5K words per second. (The transfers to and from memory in the 520ST are handled in 16-bit words.) The 68000 can access memory every 500 ns. That means its maximum bus use is 2,000,000 words per second. A worst-case calculation (dividing the

62.5K words/second rate by the 2,000,000 words/second rate) shows that DMA cannot use more than 33 percent of the CPU bus cycles.

A more realistic calculation assumes a 5-megabit-per-second rate for DMA (the standard rate for hard-disk drives) and does not assume that the highest-speed bursts of DMA would run continuously, or that the CPU would reach for memory in every cycle. With these assumptions, the DMA would rarely borrow even 5 percent of the 68000's RAM access cycles.

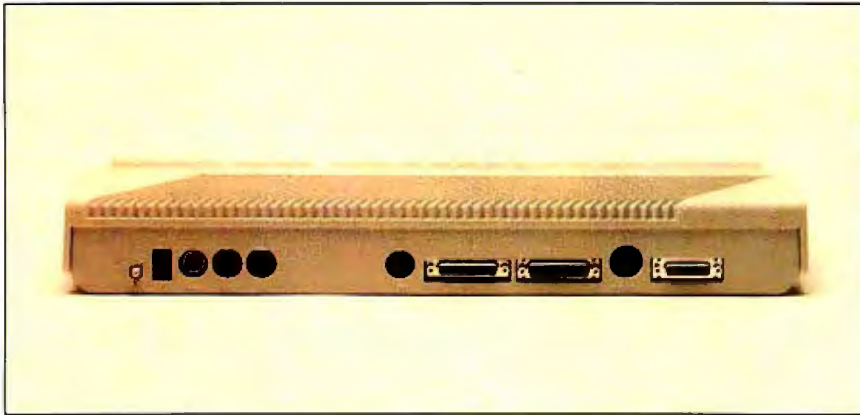


Photo 4: The back panel of the 520ST. From left to right are a reset button, the on/off switch, power cable, MIDI out and MIDI in, the monitor port, 25-pin Centronics parallel printer port, an RS-232C serial port, the floppy-disk port, and the hard-disk (DMA) port. Out of view, on the sides, are the joystick/mouse ports and the 128K-byte ROM cartridge port. Unfortunately for left-handed users, the attachment cables for the disk drives and for the mouse are short. All but the most inventive users will place the drives on the left and the mouse on the right.

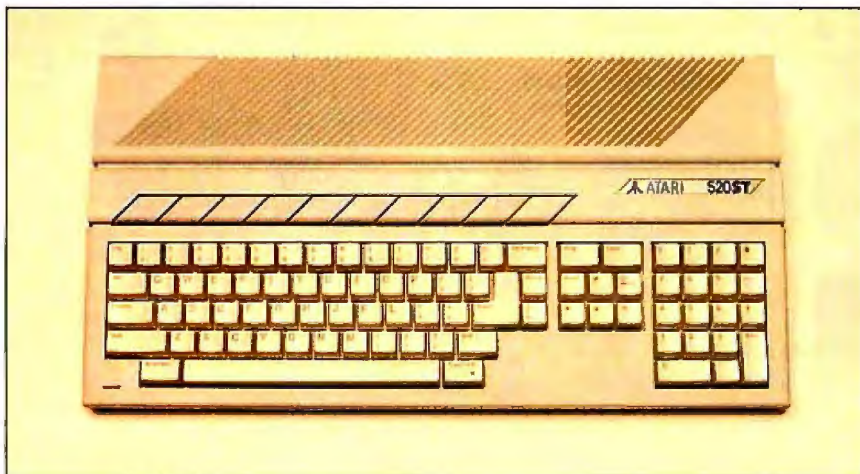


Photo 5: The 520ST keyboard. Wider keytops and the rhomboid shape of the function keys lessen the utility of an otherwise full-featured, well-designed layout.

PORTS

The serial port is a standard RS-232C interface. Some of its signals come from I/O port A of the sound chip, while others are routed through the 68901 chip. The serial port can work with asynchronous data-transfer rates from 50 to 19,200 bps.

The parallel port supports the strobe and busy signals of the Centronics parallel interface standard. Both I/O port B of the sound chip and the 68901 chip help control these lines and the eight read/write data bits. The parallel lines of the sound chip are bidirectional, which could lead to some interesting hacking. For example, you might convert a parallel printer into a scanning device to digitize information. The typical data-transfer rate is 4000 bytes per second.

The two MIDI (musical instrument digital interface) ports bear special attention. MIDI is an industry-standard interface for computers and musical peripherals. The MIDI ports will allow the 520ST to attach directly to external keyboards, synthesizers, and other equipment. Atari has even been investigating the possible use of the MIDI ports for inexpensive networking of 520STs. The interfaces work at 31,250 bps for serial transfer of information from the keyboard or a program to and from external devices. Data is organized as a start bit, eight data bits, and one stop bit.

One of the 6850 chips controls the MIDI serial communication. Up to 16 channels are allowed on the MIDI bus in one of three network addressing

(continued)

modes. The Omni mode addresses all units simultaneously and is the default mode when the computer is first turned on. Poly mode addresses each unit separately. Mono mode addresses each unit voice separately.

KEYBOARD AND MOUSE

The documentation refers to the 94-key keyboard (see photo 5) as the Atari Intelligent Keyboard because it uses its own 1-MHz 6301 microprocessor with its own mask-programmed ROM. The device scans the keyboard and the joystick/mouse ports. It provides two-key rollover and sends keyboard, mouse, trackball, joystick, and time-of-day information to one of the 6850 ACIA (asynchronous communications interface adapter) chips on the main computer board. The lines are bidirectional, and the 6850 also sends commands to the keyboard.

The QWERTY keyboard has a stan-

dard Selectric-style layout with 10 rhomboid function keys, a numeric keypad, and four cursor-control keys. Many applications for the 520ST will use two special keys, Help and Undo. We found the keyboard layout pleasant in appearance and extremely functional. It closely resembles the DEC VT-100 layout. The Control and Return keys are well placed, and the Return key is a three-key-size reverse L shape and hard to miss. The shape of the function keys, however, may make it difficult to avoid hitting more than one.

More of a problem is the feel of the keyboard. Each keytop is $\frac{1}{8}$ -inch wider than the keytops on the Macintosh and IBM PC keyboards. As a result, the keys seem much more closely packed, and you may tend to press two at a time more often than usual. In addition, the keys on our unit required noticeably more pressure than do the

keys on most other small systems. And, because connectors are attached to the rear of the unit, it is relatively difficult to adjust the keyboard.

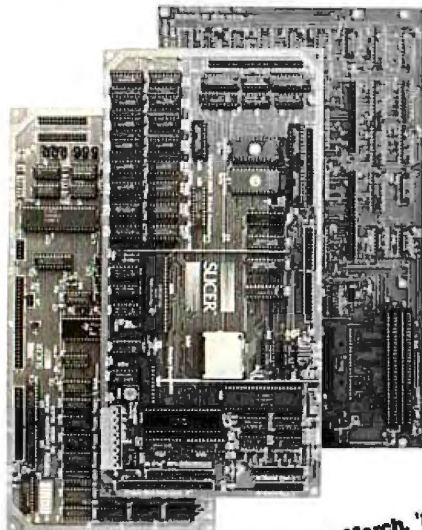
The mechanical two-button mouse, which attaches to a port on the right side of the unit, has a resolution of 100 counts per inch and can handle a maximum velocity of 10 inches per second. It has a good feel. You will use the left button for most manipulations, including select and dragging within GEM. The right button is application-dependent. For example, NEO, a low-resolution paint program, uses the right button to copy images. There are keyboard alternatives to all mouse functions, though I suspect few of you will ever use them.

DISK DRIVES

We were impressed by the high data-transfer rate of both the floppy-disk

(continued)

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see BYTE, March, '85
page 193

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BASF

drives and the hard-disk drives we tested with the 520ST. The speed is a tribute to the efficiency of the DMA custom chip and the WD1772 floppy controller. I/O is quick (no endless waiting during disk reads), and, unlike the Macintosh, you can remove disks easily at the touch of a button on the drive. The standard system currently includes one single-sided double-density drive with a capacity of 360K bytes. For \$299, you can obtain a double-sided drive that can store up to 720K bytes. Setting up the drives is slightly more unforgiving than daisy-chaining on Atari's 8-bit systems in that you must use the designated in and out I/O ports on the back of the drives. Still, adding the second drive is a distinct plus. With it, you can copy an entire disk (without the four swaps required if you don't have one) in 99 seconds and copy a 32K-byte file in 16 seconds. The disk-copy operation does not automatically format the disks, which requires an additional 54 seconds for the single-sided disks.

The disk format employed is very similar (down to the file-allocation tables) to that of the MS-DOS disks used on the Data General/One portable computer. However, the formats are not absolutely identical. We took a disk from a DG/One that contained a text file and slipped it into the 520ST disk drive. The GEM desktop on the 520ST recognized the disk and showed it contained a file, but the 520ST wasn't able to open the file for printing or display. When questioned about this, Atari admitted that a utility will probably be necessary to read the files.

FLOPPY-DISK CONTROLLER

Atari didn't design the floppy-disk controller. The design team chose a chip with a built-in data separator, a modified version of the 1770 chip from Western Digital. The old chip worked with 6-, 12-, 20-, and 30-millisecond drives. Atari asked Western Digital to change some of the drives that they support, and the new chip—the 1772—can work with 2-, 3-, 5-, and 6-ms stepping speeds. Atari is using

(continued)

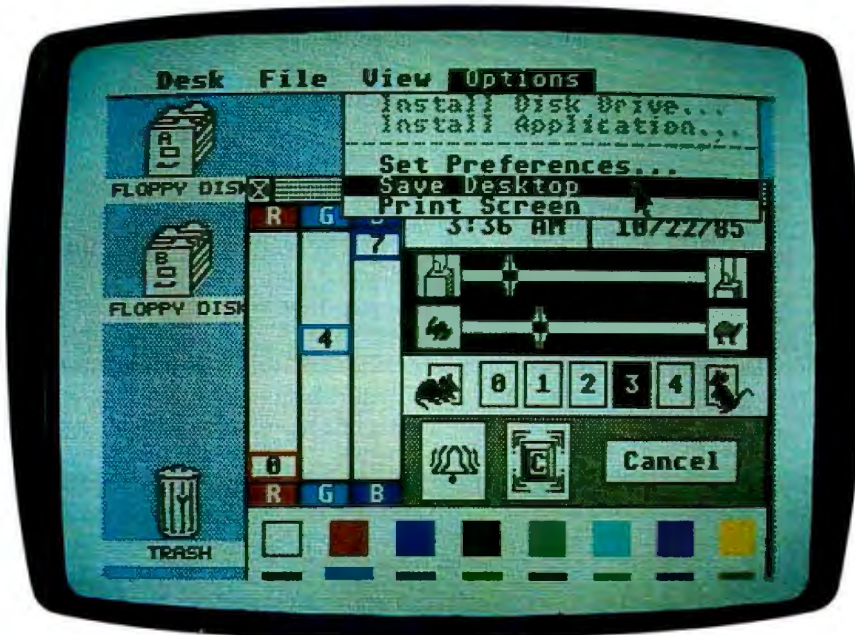


Photo 6: The 520ST desktop in low resolution, showing the control panel and a customized background color. You can fix your choices by saving the desktop.

3-ms drives. The chip uses the System/34 format. There is some incompatibility between the 1772 and the 765 controllers (the chip used in the IBM PC), although the format is the same.

The floppy interface will support a maximum of two daisy-chained floppy-disk drives. You send commands to the FDC (floppy-disk controller) by first writing to the DMA Mode Control register (to select the FDC internal command register) and then writing the desired 1-byte command to the Disk Controller register. The floppy controller works through the DMA controller custom chip, just as all hard-disk transfers do.

HARD DISK

Although Atari hasn't yet released its planned 3½-inch hard disk for the 520ST system, the company let us play with a 10-megabyte prototype, which transfers data at 5 megabits per second, the standard ST506 rate. Later drives will feature 15 megabytes and 7.5 megabits per second.

There is no hard-disk controller inside the 520ST. But the DMA custom chip makes for easy, fast interfacing.

The AHDC (Atari hard-disk controller) will be in the hard-disk-drive unit. The DMA controller sends commands to the hard disk using the ANSI X3T9.x SCSI (small computer systems interface)-like command descriptor block protocol. The AHDC supports a minimal subset of SCSI commands that are sent to the AHDC in much the same way that commands are sent to the FDC. Both floppy- and hard-disk formats contain 512-byte data sectors.

MONITORS

We used both the monochrome SM124 and RGB SC1224 monitors with excellent results. The color monitor supports low and medium resolution. You can use the monochrome monitor only for high resolution. All of the displays are clear, sharp, readable, and flicker-free, but we were particularly impressed by the clarity of the high-resolution monochrome.

The monitor you connect when you boot will determine the resolutions you will have available; there is only one monitor port, and you cannot unplug one and connect the other, since they have no compatible resolution. This may give some users a dif-

ficult choice, since much of the early software will work with one monitor or another but not both. For the moment, if you are interested in buying the 520ST for business or programming uses, you would be best served with the high-resolution monochrome system. Nonetheless, developers will undoubtedly make available resolution-independent software, in part because the developer's kit includes an appropriate directive.

TOS

TOS (the 520ST's operating system), including the GEM overlay, was to be in ROM and obviously would boot very quickly. As of this writing, however, it is in RAM where, in addition to taking up over 206K bytes of RAM, it requires 32 seconds to boot. Still, this leaves you with a reasonable amount of workspace until Atari releases the ROM version. In the meantime, 16K bytes of ROM (two 64K-bit ROM chips) hold the boot-up code for the computer. Four empty sockets within the 520ST await the new ROM chips.

The appearance of the desktop depends upon the monitor and the resolution (see photos 6 through 8). It has some unusual features and some annoyances, but for the most part, those familiar with the operation of the Macintosh will feel at home. The menu bar is at the top, you can use the mouse to resize and move windows and to work scroll bars and sliders, and you can click on file icons to format disks, to get directories, and to rename or get detailed information on files and folders. Like the Macintosh, you double-click on icons to open them, drag icons to copy files and disks, or use shift-clicks for multiple file copying. Undoubtedly, the most impressive aspect of the interface is the speed with which you are able to resize and move windows.

Those expecting a clone of the Macintosh interface, however, will be disappointed. And several of the differences are annoying. It takes slightly but noticeably longer to click on the boxes within the windows, and resizing, though quicker, is somewhat

more awkward. For example, when you click on the Resize box, the new 520ST window automatically reduces in size. On the Macintosh, it stays the same size until you decide to alter it.

There are other important differences between the 520ST and Macintosh desktops. The trash can is actually an incinerator. Move a file or folder there and it's gone permanently. Unlike the Macintosh, whenever the pointer even touches the menu bar, you bring down the menus. To eliminate the menu, you have to bring the pointer off the menu and click the mouse button. It's amazing how often this happened to us by accident. The selection process would be much improved if only you had to press the button to select menus. Second, the 520ST desktop seems to have partitions into which icons can fit. Unlike the Macintosh, in which you can place icons where you wish, the icons have a finite number of possible locations. Third, there is no option to move files, folders, and applications. The only available options are copy and delete. Therefore, to move an icon into a folder you will need to copy it there and then delete the original. And, to move a file out of a folder, matters are further complicated by the fact that the folder opens to take over the window from which it derived. You would first have to move the file to a different disk, delete the original file from the folder, then copy the file back to the original disk but not within the folder, and then delete the first copy you made. It sounds difficult because it is.

From the current desktop, you have access to a VT-52 emulator, you can install your printer, you can configure the RS-232C port, and you can set any of several defaults on a control panel. For example, if you have the color system, you can alter the palette and thus affect, if you wish, the appearance of the desktop and other applications. In low resolution, you can modify all 16 colors from the palette of 512; in medium resolution, you can modify up to 4. You can also set when and at what rate the keys will repeat with the keyboard response

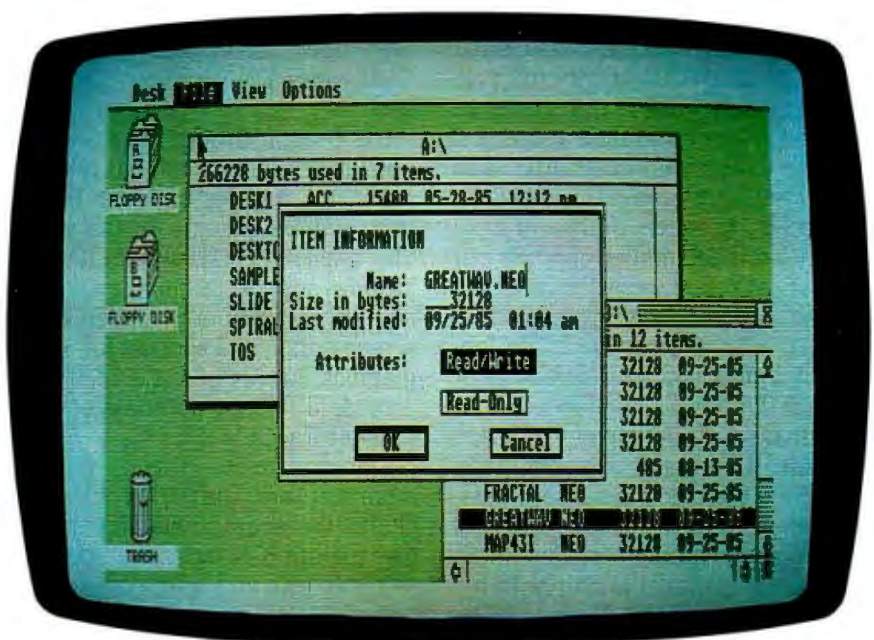


Photo 7: The 520ST desktop in medium resolution. Icons are the default, but you can easily set your preference to text.

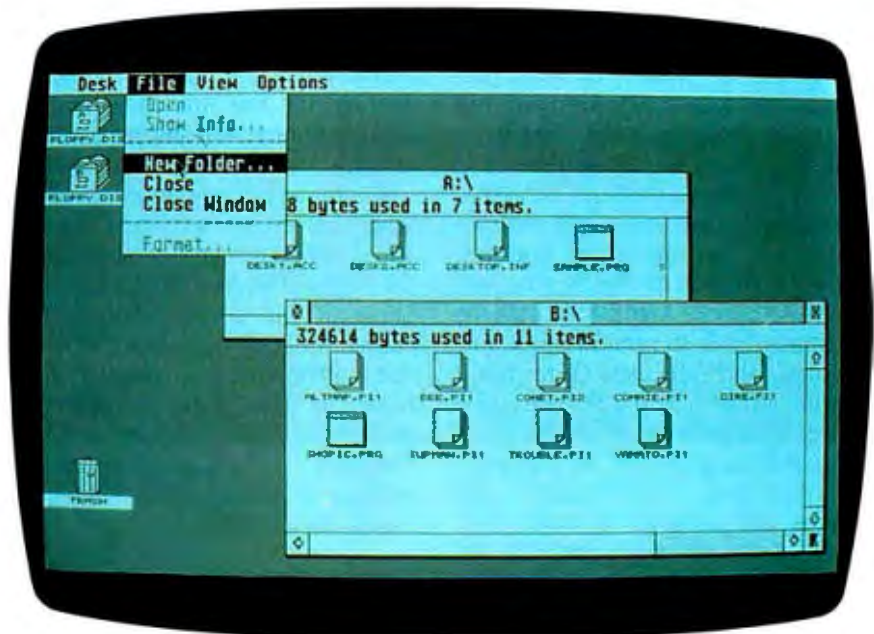


Photo 8: The 520ST desktop in high resolution.

selectors, you can alter the double-click response time, and you can activate or deactivate the keyboard click and the pleasant-sounding error warning bell. However, there are few editing amenities when resetting the time

and date, a small annoyance since the 520ST has no internal battery maintaining the clock. Most of the time, you will have to type in the entire date and time string.

(continued)

The RS232 Port Configuration window lets you fix the data-transmission rate, XON/XOFF, the parity, duplex, and the number of bits per character. The Install Printer window allows you to select between dot-matrix and daisy-wheel, between black-and-white and color, between draft and final quality, and the number of pixels per line. A Set Preferences window allows you to set the screen resolution, though your choices here are obviously limited by your selection of monitor. You can also choose not to confirm deletes and copies. Once you have set all your preferences, you can save them by selecting the save desktop option. The only absent option of importance is a command-line interface, which is available only with the 520ST developer's package.

SOFTWARE

The system comes bundled only with TOS and Atari Logo, and like other new systems, there is at present a dearth of software. Already, however, Atari has released NEO, a paint program, and ST Writer, a word processor, into the public domain, but both are surrogates until GEM Write and GEM Paint are available.

Atari Logo is surprisingly powerful. It makes full use of the GEM environment and, among many features, allows you to edit on the fly. Atari will soon also bundle Atari BASIC with the machine. Our beta version is fast, full-featured, and also uses GEM, but it was constricted by a 32K-byte workspace. Undoubtedly, however, most users will be attracted by the availability of serious development languages, the absence of which held back software development on Apple's Macintosh for most of its first year.

TDI Software Ltd. (29 Alma Vale Rd., Clifton, Bristol BS8 2HL, England) has released Modula-2/ST, a 32-bit development system that includes an editor, compiler, linker, and library facilities. TDI's Modula-2 is a full implementation, has complete libraries for TOS, and provides full access to the 520ST's graphics features. TDI is also marketing a version of UCSD

Pascal with the p-System, which, however, does not include support for GEM. Both TDI products cost £195 each.

The Dragon Group (148 Poca Fork Rd., Elkview, WV 25071) has released 4xFORTH, a series of 32-bit FORTH development systems for the 520ST. The basic 4xFORTH system (\$99.95) includes support for multitasking and multiuser access, a compiler, a full-screen editor, and support for 520ST graphics. For \$149.95, 4xFORTH also provide a floating-point system and support for GEM calls.

Atari has released its C development software. The \$300 package includes the entry points and C bindings to both TOS and to the operating system's text and graphics routines (such as text size, attributes, alignment, and angle, as well as circle drawing, area fill, and bit-blitting). The documentation also provides the "Hitchhiker's Guide to the BIOS," information on Kermit and MIDI, a C programmer's guide, and much more. Purchasers of Haba's Hippo-C, now available for the 520ST, should be warned that the Atari development documentation will still be essential reading.

Several other companies are promising interesting additions to the 520ST language group. Metacomco (26 Portland Square, Bristol BS2 8RZ, England) will soon distribute ISO Pascal, a 68000 assembler, and Lattice C. Philon Inc. (641 Avenue of the Americas, New York, NY 10011) is readying a BASIC compiler, a BASIC interpreter, and a C compiler. It is also working on compilers for FORTRAN, Pascal, and COBOL.

SYSTEM DOCUMENTATION

It is fortunate that the system is so easy to learn to use because the documentation is quite poor. The 80-page owner's manual has requisite sections on setting up the system, getting started, touring the GEM desktop, and managing disks, files and folders, but it has very little technical material. Materials with the disk drive and monitors are also sadly lacking. Undoubtedly, users will have to wait for

the trickle of technical references on working with the hardware.

CONCLUSION

Judging from the conversations around the office and on BIX (BYTE Information Exchange), CompuServe, and The Source, there is a storm of interest in comparing the relative capabilities of the 520ST, the Amiga, and the Macintosh. There is, in fact, far more interest than there seemed to be in comparing the merits of the 8-bit computers from Atari, Apple, and Commodore. An upcoming special edition of BYTE on the 68000 will make comparisons of processor and application speeds, ease of development and portability, and user interfaces, but we are still left with our conclusion that these are very different machines, with very different markets.

The 520ST is an architecturally simple 68000 computer with high-quality video output and a high-speed DMA port. The easiest way to summarize our first look at the hardware is that the 520ST presents the 68000 unbounded. Not only does it offer an excellent price/performance ratio, but we expect it to produce some impressive benchmarks on tasks with heavy computation.

The 520ST's complete keyboard and impressive array of ports add up to an attractive system. Finally, the 520ST's use of standards (for example, 68000, MIDI, Yamaha sound chip, and Western Digital FDC) should make it easier to program, expand, and manufacture.

There are also the promised cheap, powerful peripherals: a 10-megabyte hard disk for \$700, a ½-gigabyte CD-ROM optical disk for around \$500, and a 1200-bps modem for \$150.

The Atari 520ST is certainly an excellent value. For the moment, there is not much application software and you still have to deal with an unfinished operating system; but with the current availability of several high-level languages, the 520ST will undoubtedly provide many users with what they seek—a means to tap the power of the 68000 at a price they can afford. ■

SOFTWARE • OTHER COMPUTERS

Two for the Amiga

MaxiCorp has released a set of business-oriented modules and a serial communications program for the Commodore Amiga.

Maximillian contains four modules: MaxiCalc, a spreadsheet that can handle 256 rows by 256 columns; MaxiWord, a word processor; MaxiGraph, for drawing bar, line, and pie charts; and MaxiTerm, a communications program that can operate with data speeds up to 9600 bps. With a 256K-byte Amiga, you can use any one of the applications; with a 512K-byte machine, you can use all four together.

MaxiComm, another communications program, is capable of terminal emulation and file transfers between the Amiga and on-line services and data transfers between Amigas. Both XON/XOFF and XMODEM protocols are available.

Maximillian lists for \$195. MaxiComm is \$49.95. Contact MaxiCorp, 2817 Sloat Rd., Pebble Beach, CA 93953, (408) 625-4104. Inquiry **583**.

RAM Disk, RAM Upgrade for 520ST

Lamar Micro has developed a RAM-disk program for the Atari 520ST. Called RAM Overdrive, the program lets a 520ST with 1 megabyte of RAM address the upper 512K bytes of random-access memory as a RAM disk.

One way to fatten your Atari so it can use the RAM disk is with Lamar's 1-megabyte RAM upgrade. When used with a word-processing program such as ST Write, this RAM expansion lets ap-

proximately 688K bytes (or 344 typewritten pages) reside in memory at all times. The operating system automatically detects this increase and makes the 688K bytes available to the application.

RAM Overdrive costs \$34.95. The RAM upgrade is \$300. You have to send your keyboard to the company for installation of the RAM. Contact Lamar Micro, 2107 Artesia Blvd., Redondo Beach, CA 90278, (213) 374-1673.

Inquiry **584**.

Pascal for Ataris

Draper Pascal lets you create, compile, and execute Pascal programs on the Atari 400, 800, XL, or XE computers. It incorporates features from UCSD and ISO standards and has extensions, such as sound and graphics, that take advantage of Atari hardware.

Machine-language subroutines can be loaded and called, and program chaining is supported. Draper puts no limit on the size of source-code programs. A one-pass compiler generates pseudocode directly; maximum size of program pseudocode is 30K bytes. Execution debugging tools include instruction trace and stack display. No linking is required.

Draper Pascal needs only one disk drive and 48K

bytes of RAM. It costs \$44.95 (plus \$2 shipping) and comes with a manual and sample programs. Contact Draper Software, 307 Forest Grove, Richardson, TX 75080, (214) 699-9743. Inquiry **585**.

CP/M for Z8000

Digital Research and Zilog have jointly developed CP/M-8000 for the Z8000 16-bit microprocessor. CP/M-8000, which is being marketed by Toshiba and Zilog, features an enlarged directly accessible memory space beyond 64K bytes. The developers say the new CP/M has an improved file manager and command repertoire as well as increased capability for library maintenance.

CP/M-8000 comes with a C compiler, assembler, linker, debugger, and utilities. Personal BASIC, Compiler BASIC, FORTRAN, and Pascal/MT+ are slated as options. Toshiba's offerings for the operating system are a PL/M compiler, a macro assembler, a PROM writer, a download utility, and a screen editor.

The new CP/M can operate with a Z8001, Z8002, Z8003, or Z8004; a minimum of 176K bytes (256K is recommended); and up to 16 disk drives. It comes on single-sided single-density 8-inch floppy disks or on double-sided double-density

5¼-inch disks. Prices start at \$340.

Contact Toshiba Corp., 1-1-1, Shibaura, Minato-ku, Tokyo 105, Japan; telephone: (03) 457-2104; Telex: J22587. Inquiry **586**.

Atari Tools

Volume One of the Atari ST Toolbox contains five utility programs on a single disk. The programs are Disk File/Sector Editor, Memory Editor, Fast Format & Copy, Deleted File Recovery, and Directory Print. Volume One costs \$39.95.

Contact Mirage Concepts Inc., Suite 108, 4055 West Shaw Ave., Fresno, CA 93711, (209) 227-8369. Inquiry **587**.

Software-Development System

Described as a fourth-generation language, Sculptor is designed to reduce programming time by using menus written in plain English and screens created with any text editor. Microprocessor Developments Ltd. says Sculptor can cut programming time by as much as 80 percent.

The system uses a B-tree access method. It's transportable to a variety of computers using MS-DOS or PC-DOS. Multiuser applications can be developed for systems running under UNIX, UniFLEX, and OS-9.

Contact Microprocessor Developments Ltd., 1/3 Canfield Place, London NW6 3BT, England; telephone: 01-328-2277. The U.S. representative is Gander & Flynn Ltd., 225 Dyer Rd., West Palm Beach, FL 33405, (305) 832-0131. Inquiry **588**.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, 70 Main St., Peterborough, NH 03458.

Atari's 1040ST: 1 Megabyte for Less Than \$1000

The new 1040ST from Atari is a direct successor to the 520ST, but it has 1 megabyte of RAM, an internal power supply, an internal RF modulator, and a built-in double-sided 3½-inch floppy-disk drive. Atari's computer dealers will offer a 1040ST and a monochrome monitor for \$995. The TOS operating system has reached final form and will be in ROM inside both the 1040ST and the 520ST. Any 520ST applications that follow TOS and GEM rules will run on the 1040ST.

The 520ST will still be available, but it will be unbundled and sold as a mass-market item. The new prices will be: 520ST, \$299; single-sided disk drive, \$199; double-sided disk drive, \$299; monochrome monitor, \$199; color monitor, \$399. A 20-megabyte hard-disk drive will be sold for approximately \$700.

Apple Adds a Plus to Both Macintosh and LaserWriter

Macintosh Plus has now joined the Macintosh family; LaserWriter Plus joined the LaserWriter in a family of two. The Mac Plus doesn't have any expansion slots and still uses both the 9-inch 512- by 342-pixel screen and 7.8336-MHz 68000 processor. The pluses are 1 megabyte of RAM, 128K bytes of ROM, an 800K-byte double-sided disk drive, an SCSI interface, and a keyboard that includes a numeric keypad and cursor keys. The LaserWriter Plus is faster than the LaserWriter and contains more built-in fonts within a full megabyte of ROM. The RAM in the Mac Plus is contained in four socketed SIMMs (single in-line memory modules), which are small boards with leads on only one side and 256K-bit surface-mount DRAM chips soldered to the top. When 1-megabit surface-mount DRAMs are available, the Mac Plus can be upgraded to 4 megabytes of RAM. The ROM contains a faster QuickDraw and Finder 5.1 with the Hierarchical File System. Other changes include a RAM-disk utility on the pull-down Control Panel. The SCSI interface allows easy connection to industry-standard peripherals like hard disks. The 800K-byte disk drive is a half-height double-sided version of the Fat Mac's Sony drive that is twice as fast. Macintosh Plus will not come bundled with MacWrite and MacPaint.

Apple also announced that any Macintosh can be upgraded to the Mac Plus level. For \$299, you can buy a Disk Drive Kit with both an 800K-byte internal disk drive and the new ROMs. For \$599 (for Fat Mac owners) or \$799 (for 128K-byte Mac owners and Fat Mac owners with unofficial modifications to their machines), you can buy the Logic Board Kit that contains the new digital board and a new rear housing. However, Logic Board Kit buyers must also buy the Disk Drive Kit to get the new ROMs. For \$129, you can buy the new keyboard. To protect those who bought Fat Macs in the 60 days prior to the Mac Plus announcement (November 18 to January 16), Apple is offering half-price Disk and Logic upgrade kits. External 800K-byte disk drives will be sold for \$499. All of the upgrade prices include the dealer's installation fee.

The LaserWriter Plus carries a \$6798 price tag. The \$5999 LaserWriter can be transformed into a LaserWriter Plus with the addition of a \$799 Font Kit.

Page Scanner for the IBM PC

As evidence of the burgeoning interest in scanning and OCR (optical character recognition), DEST Corporation of Milpitas, CA, has introduced PC Scan, a page scanner for the IBM Personal Computer. The PC Scan box itself costs \$1995 and measures 4 by 11½ by 16 inches—about the size of a standard dot-matrix printer. Because the pages are fed in and out of one side of PC Scan, you can put it under a disk drive, printer, or terminal. The PC Scan controller board contains an SCSI interface, costs \$195, and plugs into an IBM PC, XT, or AT.

PC Scan automatically scans one sheet at a time. It isn't very picky about what sort of

(continued)

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ATARI I/O BUS

Dear Steve,

Do you know where I can get information on the Atari 800XL's parallel I/O bus? It is accessible on the back of the XL through a 50-pin edge connector. I can't seem to find anything on it anywhere.

ALAK KUMAR DEB
Sunnyvale, CA

Antic magazine ran a four-part article entitled "Parallel Bus Revealed" by Earl Rice; it contains pin-out information as well as software and hardware examples. Part 1 begins in the January 1985 issue.

Also, one source of circuit diagrams for the more popular microcomputers, including Atari, is Sams Computerfacts, which is available from

Howard W. Sams & Company Inc.
4300 West 62nd St.
POB 7092
Indianapolis, IN 46206

The one for the Atari 800XL (product number 008951, set number CC11) sells for \$19.95.

Sams Computerfacts are technical service manuals. There are no explanations of the circuits, and the price may be high, but if you already have some knowledge of interfacing, they may be sufficient.—Steve

GERMAN CHARACTERS

Dear Steve,

I have an IBM PC XT and want to use Framework on it. However, I have much writing to do in German, and this requires special characters (such as umlauts). A couple of months ago I read how to emulate a German keyboard so that the special characters I need appear on the screen. (Unfortunately, I didn't keep that BYTE issue.) I have contacted Ashton-Tate about my problem, but they had no answer except that I should wait until a German version becomes available.

I have a daisy-wheel printer, so I can easily switch the print wheels. Any ideas about how I can solve my problem?

KARL H. MAURITZ
Cleveland, OH

It appears that the IBM PC has all the characters you need in its extended character set, so all you need is a program to make some key combinations (e.g., Alt-A, Alt-B) display German characters.

(continued)

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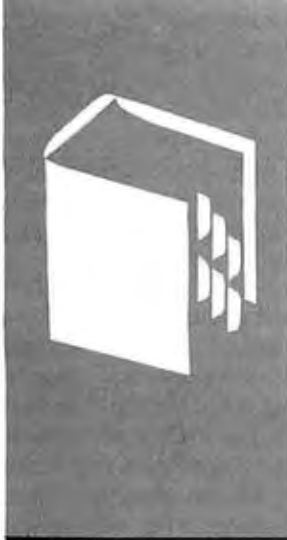
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Programming Tools and the Atari 520ST

Atari 520ST

TDI Modula-2/ST

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BY BRUCE WEBSTER

First of all, I'd like to thank all who have sent comments via BIX (BYTE Information Exchange), CompuServe, MCI Mail, the nets, and (oddly enough) the U.S. Postal Service. Some of the messages have been quite glowing; others have been, er, hot. But I do appreciate them all—it's nice to know that folks out there are actually reading this column and that what I have to say is interesting enough to provoke some response.

The most common request I get is to include some sort of "time stamp" in the column, so that it's clear up front when it is being written. I've done that some in the past, but apparently not consistently or clearly enough. I am writing this in the second half of October, long before you'll be reading it. COMDEX/Fall is still more than a month away, and rumors are just now coalescing into firmer shapes about what Apple will announce at its annual shareholders' meeting in late January—which will be an accomplished fact by the time this sees print.

THE ATARI 520ST

In the October 1985 issue of BYTE, I spoke highly of the Commodore Amiga. Those comments were written in June, a few weeks after having attended the Amiga developers' conference. Back then, I hoped to have my hands on an Amiga within a month or two to give a firsthand report. No such luck. However, a few weeks ago, the system that is seen as the Amiga's main rival did show up: the Atari 520ST. Even as I type this on my Compaq, the ST is running a batch file, performing the linking needed to create a runnable program. The system I have to evaluate has the monochrome monitor and two single-sided (360K-byte) disk drives. Such a system lists for around \$1000, although off-the-shelf cost right now would be at least \$100 less. Here are some of my first impressions.

First, physical appearance. The ST looks like a home computer, with external com-

ponents (disk drives, monitor, etc.), lots of thick cables, external power supplies, and an overall design that doesn't allow stacking. In fact, a market for ST cabinets will probably appear quickly, just to reduce clutter and allow a more vertical arrangement of components. And a power strip or outlet expander is a necessity: A two-drive ST with monitor and printer requires five outlets (as opposed to two for an equivalent Mac system). Such a system will have three external power-supply boxes, which (thank heavens) have cables long enough to be dropped out of sight behind a desk or under a table. The ST itself is wide (about 20 inches); when you add a work area to one side for a mouse, you find that you need a lot of horizontal space to set the machine up. For that matter, the whole system takes up more room than any other computer I have (Compaq, Mac, Apple IIe); a custom cabinet of some sort would definitely help out.

Using the ST is easy, especially if you've used the Macintosh. The ST uses GEM (from Digital Research) as its graphics system on top of TOS (the operating system) and GEM Desktop as its user interface on top of GEM. GEM Desktop looks much like the Mac's user interface—so much so, that Digital Research just agreed to make some changes to it to avoid a copyright-infringement suit from Apple. What effect that will have on the ST (or, for that matter, the Amiga, whose Intuition user interface is also Mac-like), I don't know. Atari may have to send out GEM Desktop updates, or it may be able to ignore the whole issue for now.

Though GEM Desktop in its current incarnation looks a lot like the Mac interface, it isn't nearly as powerful or intelligent. All open windows must have the same format (icon versus text; sorted by name, size, type, date); windows are not automatically updated as disks are ejected and inserted; to change a filename, you must select its icon, then select the Show Info option in the File

(continued)

Bruce Webster is a consulting editor for BYTE. He can be contacted c/o BYTE, POB 1910, Orem, UT 84057.

Atari, like Amiga, learned many lessons from Apple's problems with the Macintosh.

menu, then edit the filename in the resulting window; you cannot recover files thrown into the trash can; and so on. If you don't like the Mac's interface, you'll probably hate GEM Desktop.

Some performance differences between the ST and Mac user interfaces stand out immediately. First, the ST (perhaps because of GEM) is somewhat less responsive to mouse clicks. Often, I have to double-click a program icon several times to get it to run; likewise, if I want to resize a window, I have to point to the resizing box, click, and wait until the dotted outline appears before moving the mouse. Also, as mentioned, updating of windows (as disks are popped in and out of the drives) is not automatic. You have to specifically request it.

On the positive side, overall interface performance appears to be faster than on the Mac. Windows seem to pop up faster, programs load more quickly, and so on. Best of all, once you've booted up, you can pop the system disk out and forget about it. Unlike the Mac, the ST appears to load the entire operating system in and keep it resident, so that you don't always need a system disk mounted somewhere (or do a lot of disk swapping). Of course, that means the operating system is chewing up a pretty fair amount of RAM (random-access read/write memory), especially since GEM and TOS are not in ROM (read-only memory), as they were originally supposed to be.

Okay, so far the first impressions haven't been too positive. Well, they're getting better. Atari, like Amiga, learned many lessons from Apple's problems with the Mac. For example, the ST has a DB-25 "parallel" port, just like the one on the IBM PC and clones, that uses the standard IBM printer cables to hook up to parallel printers. It also has a standard DB-25 serial (RS-232C) port. Why is this a smart move? Well, I unplugged my printer and modem cables from the Compaq and replugged them into the ST. I selected the Print Screen function in the drop-down Options menu, and the ST did a graphics dump of the screen to the Epson RX-80 printer. I then selected the VT52 Emulator desk accessory and was able to call BIX via the Hayes Smartmodem 1200. No hassle, no setup (although printer- and serial-port configuration programs were there for me to use). Very, very nice.

Sheer graphics speed seems to be generally better on the 520ST than on the Macintosh. I picked up and modified a simple graphics benchmark off of ARPANET, apparently written by Fons Rademakers at CERN in Switzerland to compare the Mac with the Apollo workstations. The program draws several thousand lines of a fixed

length and (for each run) a fixed angle. A listing of the program and complete results will be given next month (so that Amiga times can be included). Generally speaking, the Atari was quite a bit faster than the Mac. The Mac was faster for true vertical lines, but even a slight skew made the Mac almost 10 times slower than the Atari. Similarly, the Mac was faster for almost-horizontal lines, but as the lines became more slanted, the Mac slowed down by a factor of 30, while the Atari's speed remained relatively constant. Again, look for complete numbers and other benchmarks next month.

As with all new nonclone computers, software for the ST is currently sparse, so I haven't been able to do more to try out the ST. The release of GEMDraw and GEMWrite has been delayed because of the Apple agreement (Digital Research has to make them look less like MacPaint and MacWrite). As a result, Atari has released the freeware program Neochrome, a nice color-oriented painting program that I can't use on my monochrome monitor, and an ST version of Atariwriter. Look for more comments here about the ST as time goes on.

TDI MODULA-2/ST

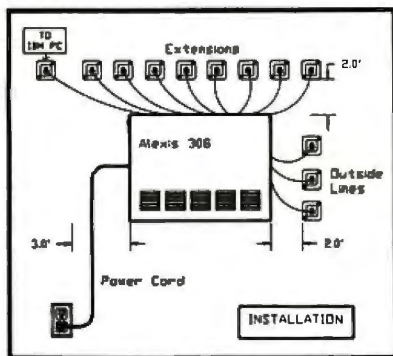
The ST came with Atari's development system, which is Digital Research's C compiler, linker, and 68000 assembler. I tinkered around with it for a while, until I was rescued by the arrival of a native-code Modula-2 compiler from TDI Software Ltd.

TDI Modula-2/ST is a well-done package. First, it comes with a Mac-like program editor that uses both mouse/menu and keyboard commands, so aficionados of both styles will find it pleasing. The editor also has the best "jump to compiler error" feature of any I've seen. When you compile a module, the compiler doesn't stop at the first error but goes through and finds all the errors. When you go back to the editor, it automatically positions you at the first error—shown in the text by @—and prints a message at the bottom of the screen telling you what the error was. You then hit F7 (or use a menu command) to jump to the next error.

The compiler is moderately fast and easy to use. If it can't find the necessary .SYM files, it stops and lets you look on other disks or within folders for the appropriate file. As mentioned above, it finds all errors, instead of stopping at the first one, and produces an error file, <filename>.ERR, which is pretty much worthless by itself, but which the editor uses as described above.

The linker works much the same as the compiler does; that is, if it can't find the necessary file, it brings up a standard GEM file-selection box and lets you go looking for it. Unfortunately, this is another area where GEM suffers in comparison to the Mac: It is tedious to look at another disk drive (you have to go up and edit a filename pattern). Things are further complicated by the fact that folders are true subdirectories, so if you use them to store all your .LNK or .SYM files (of which there are many), the com-

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Of course, the list is extendable by anyone who cares to write his or her own printer driver. There are a few other drivers that are just around the corner. Watch this conference topic for details.

amiga/tutorial #102, from pariseau

TITLE: Printer Escape Sequences (LONG)

AmigaDOS provides three "handlers" that can be used to do I/O to a printer. These are "par:," "ser:," and "prt:," referring to parallel, serial, and printer, respectively. If you want to do output to the printer using the file system routines, you will Open() one of these and do Write() calls to it. The CLI commands also expect you to use these strings as file parameters. For instance, you can send a file to the printer handler with the command "copy myfile to prt:". Similarly, you use these handler names when trying to write to the printer from languages like ABASIC. (For compatibility, Microsoft's Amiga BASIC also defines LPT1 to be the same as prt:.)

An AmigaDOS handler is simply a piece of interface code that translates the device-independent file system calls like Write() into the appropriate message traffic to the "devices" implemented in Exec, the multitasking kernel of the Amiga. The par: handler uses the device "parallel.device," which is the Exec code that manages the parallel port connector on the back of your Amiga. The ser: handler uses the device "serial.device," which manages the serial port connector.

Simply put, when you do output to par: or ser: you are talking straight through to the hardware—with no intervening levels of interpretation. If you have an Okimate 20 printer connected to your parallel port, then escape sequences sent to par: will reach it directly and will have whatever effect they are defined to have by Okidata.

Printing to par: or ser: is pretty straightforward. Keep in mind that a standard AmigaDOS text file uses LF as a line separator (not CR or CR-LF), and that a file may or may not have an LF at the end. You may want to add a carriage-return character to the ends of your lines (in a simple program you create), or, if your printer offers this option, flip the switch that automatically gives you a CR when the printer receives an LF.

(Note: Input from par: and ser: is somewhat more complex, since they do "buffered" I/O—but I digress.) If you are writing a program, you can avoid all this handler stuff by doing an OpenDevice() directly on the Exec device you are interested in talking to. You then pass I/O request blocks to the device using the I/O calls provided by Exec (DoIO() and friends). The advantage of talking directly to the device is that you get a lot more flexibility, including things like asynchronous I/O and the ability to set device parameters such as serial baud rate. For more information on how you call the system library and device routines and just what functions are available, please look in the Amiga "ROM Kernel Manual" (which will be in the stores shortly!).

Note that the Preferences tool printer settings have *no effect* on the function of the par: and ser: handlers! (Preferences *is*, however, used to set the default baud rate used by ser:.) Any special function you want your printer to do is *up to you* when you use par: or ser:. You must choose the correct escape sequences to send to do even initialization-style functions—such as setting the margins. Obviously, this obliges you to *know* what style printer is connected to your Amiga and whether it is connected to the serial or to the parallel port.

Which brings us to prt:. The prt: handler uses the Exec device "printer.device." The printer device uses the information it finds in the Preferences settings to understand the type of printer you have connected and how you want it to be used. On the basis of the printer port setting you've made in Preferences, the printer device talks to either the serial or the parallel device to reach the printer.

The printer device understands *only its own, printer-independent, escape sequences*. It converts these escape sequences into the

printer-specific escape sequences appropriate for the printer currently selected in Preferences. In addition, the Initialize function (which is invoked when you open the printer device or when you send it the Initialize escape sequence) causes the appropriate escapes to be sent to your printer to configure it according to the options you have selected in Preferences. This, for instance, is how your margin settings get sent to the printer.

If you use the printer device (or prt:), you can write code that is largely independent of the type of printer your customers have on their Amigas.

Note that when using the printer device (or prt:), you should *turn off* any option on your printer providing for an automatic CR, LF, or CR-LF to be generated whenever the printer receives an LF. The printer device will provide end-of-line CR-LFs as needed. Also note that, in addition to the alphanumeric printing described here, the printer device provides for black-and-white, gray-scale, and full-color, raster-graphics printing. This function is only available when talking directly to the printer device (not from prt:).

Known Bugs

The V1.0 Serial Device (and thus, ser:) does not read reliably at the higher baud rates. Writes work just fine. The serial device uses Ctrl-S/Ctrl-Q (XON/XOFF) flow control *only* for V1.0.

The V1.0 Printer Device does not correctly interpret length = -1, which is supposed to indicate that you've given the printer a null terminated string. Prt: is not affected by this, since the handler code always feeds the printer device the correct length.

ATARI

Both the Atari and Amiga conferences contain numerous messages comparing the merits and inherent problems of the two computers, but there is, as well, considerable interest in making the most of each machine. This month for the 520ST, we include some technical tips, including instructions on upgrading the computer to 1 megabyte of RAM, mention some minor bugs in GEM/TOS, and cover some of the discussion concerning the compatibility between the color and monochrome systems.

1-MEGABYTE MEMORY UPGRADE

Message 53 in Atari/tech explains how to upgrade the Atari 520ST's 512K-byte memory to 1 megabyte. [Editor's note: Before attempting the upgrade, we recommend that you check BIX for Gert Slavenberg's latest upgrades and for the comments of those who have attempted the procedure.] Gert Slavenberg explains that TOS automatically recognizes and uses the added memory. The expansion requires a lot of very delicate soldering and desoldering and resoldering—and of course voids the Atari warranty.

Message 54 provides Gert Slavenberg's complete C source code to create a RAM disk, which requires the 1-megabyte memory expansion. [Editor's note: You can also download the source code from BYTEnet Listings (617) 861-9764 as STRAMDSK.C or obtain it on disk (see page 350).]

atari/tech.st #53, from Gert Slavenberg

Warning: This is a hardware modification that will void the warranty of your 520ST. If you do not have the appropriate tools or experience, you have a substantial chance of ruining your 520ST.

(continued)

Proceed at your own risk! I have not checked with knowledgeable sources at Atari to verify if this modification endangers the long-term machine reliability and/or software compatibility (I suspect it may endanger their software compatibility . . . if enough of us do it!).

Tools and components needed:

Sixteen 256K by 1 RAM chips, 150-ns access time type, e.g., NEC 41256C-15.

A good-quality, preferably temperature-controlled, soldering iron, with a miniature tip (tip should be narrow enough to avoid touching two IC pins at the same time), e.g., Weller-type soldering station.

Good-quality resin core solder (thin).

Approximately 4 feet of wire-wrap wire and a good stripper for it. (You will have to route three wires over a sequence of IC pins. The easiest way to do this is to have a stripper allowing you to shift the insulation forward over the wire, solder the next point, measure new length, shift over insulation, etc., until the endpoint). The "No Nik" 0.014 (dark-green handle) wire-wrap stripper is the best tool for this.

Desoldering wick and solder suction tool.

Phillips-type screwdriver (for opening your ST), tweezers, pliers, etc.

A steady hand and self-confidence.

Explanation of the modification:

(Please read the rest of this document before starting. It may save you time and a 520ST.) The current memory inside the 520ST consists of sixteen 256K by 1 RAM chips. Address (A0..A8) lines are common to all those chips.

The WriteEnable line is also common to all chips. Data (in and out) lines are, of course, individual. The RAS (row-address strobe) line is common to all chips. The eight chips forming the high-order byte group have one common CAS line, and the eight forming the low-order byte group have one common CAS line (CAS is used as enable for write operations, such that WriteEnable can be common to both groups).

The high-order group from MSB to LSB consists of U45, 44, 43, 42, 38, 34, 33, and 32. The low-order group is U30, 29, 28, 25, 24, 18, 17, and 16. Note that all chips are adjacent, though the numbering has gaps. RAS0, CAS0H, and CAS0L are supplied from U1 pins 8, 6, and 7, respectively. (The 0 indicates bank 0.)

Bank 1 that you are going to build in will be "piggybacked" on top of the current chips, where all pins of the new chips *except* RAS (pin 4) and CAS (pin 15) are soldered to the old chips' equivalent pins. Thus, they will end up sharing addresses, data, WriteEnable, and power and ground with the existing chips.

All RAS pins of the new chips are wired together and will be supplied with the RAS1 signal generated on pin 18 of U15 (the memory controller, marked 3H-119C or so). The CAS pins of the eight new high-order byte chips (on top of U45..U32) are wired together and supplied from the CAS1H signal generated on pin 22 of U15. Analogously, the CAS pins of the new U30 to U16 are wired together and supplied with CAS1L from pin 21 of U15.

How to go about it:

Step 1: Open up your 520ST, pull off the keyboard connector, and remove the main circuit card from its top and bottom shielding. Make sure to remember which screws go where, and note the keyboard connector orientation.

Step 2: Desolder all of the capacitors adjacent to the existing RAM chips. (*Do not skip this step.* You'll lose time if you do, and worse, the modification will not be reliable since you can't solder pins obstructed by the capacitors reliably [if at all]).

To desolder them, I found it easiest to heat the island on the non-component side and bend the wires straight. After doing that on each

capacitor, turn over to the component side and heat the islands while pulling the capacitor out with the tweezers.

Step 3: Open up the holes of all the desoldered capacitors, using a combination of desoldering wick and suction tool. Do this from the noncomponent side. If certain holes are difficult to open up, you may want to use a wood splinter (push it through while heating). Be careful to remove all solder debris!

The reason for opening the holes *now* is that they will be less accessible once you've done the other steps! Patience is a virtue.

(Note: Steps 2 and 3 are the only ones that may damage your ST PC board. Be sure not to use excessive force while pulling out the capacitors. If you damage your PC board anyway, cure the problem now and not later.)

Step 4: In this step we will piggyback the new RAMs on top of the old ones. Be sure to connect all pins except pins 4 (RAS) and 15 (CAS). The best way to go about this is to do it chip by chip.

First, bend the pins of the new RAMs such that they are perpendicular to the package (instead of having slightly spread "cowboy legs"). Use pliers to bend pins 4 and 15 such that they come out of the IC package horizontally, and cut off the excess length of pins 4 and 15 (I mean part of the pin, you still need to be able to solder to it!). Make sure that the new RAM fits snugly on top of the old one (in the same orientation!), without intervening space and with the new pins touching the old ones.

Now solder each pin (except the nontouching 4 and 15) to the other RAM's. The best way to do this with the least chance of damage is to touch both the new RAM's pin and the old RAM's pin. Heat them both for a second and add a *little* solder then. Wait till the solder flows. After each IC, check all pins carefully to assure a good connection (use a magnifying glass).

Note: This step is crucial for the long-term reliability of the memory extension. A badly soldered joint may show up later as sporadic memory errors. *Take your time.*

(Note: Until step 6 is finished, do not in any way apply power to your ST. This intermediate state of affairs will damage your memory chips.)

Step 5: Remount all the desoldered capacitors. Bend the pins like they were before resoldering, so that they will not touch the lower shielding. Solder from the noncomponent side.

Step 6: In this step you will route the three wires mentioned earlier. The first wire connects pin 4 (RAS) of all the new RAMs to pin 18 of U15. The second wire connects pin 15 (CAS) of the new U45 to U32 to pin 22 (CAS1H) of U15. The third wire connects pin 15 (CAS) of the new U30 to U16 to pin 21 of U15.

The best way to do this is to use the stripper to remove 5 inches of insulation. Solder the first IC pin to the end of the blank wire, measure the distance to the next pin in sequence, and shift over that amount of insulation. Continue in this fashion until all the pins in sequence are done. Work from U45 to the left, soldering directly to the leftover pins on the new chips.

Make sure that no wire or solder sticks out above the top plane of the new chips, since they will almost touch the top shielding! Route the wires through the PC board hole below and to the left of U15 to connect to U15 on the noncomponent side.

Step 7: Sit back. Use Brain. Do you feel confident about the quality of your work? No mistakes? Check everything once again if you are but a little uncertain. Applying power with errors might make your ST into a decorative, nonfunctional piece of art. OK. Either rebuild your ST into its shielding and cabinet, or put it onto a surface clear of wires and solder remains and connect it to monitor, disk, and supply.

Boot it. If it boots, you're probably there. Test if the new memory works by looking at the phystop variable (\$42E) with SID if you have the developer stuff. It should read \$100000. Also note that memcntl

(continued)

(\$424) now holds 5 instead of 4, and that v__bas__ad (\$44E) now holds \$F80000 (screen bit-map origin).

If you don't have the developer stuff, try a single-drive copy and check that you get the whole disk in one buffer instead of two. If the new memory does not seem to exist, use SID to deposit and retrieve words on locations \$80000 and up (½ megabyte hexadecimal). If bit errors occur, the ST boot ROM did not detect the extension (it checks all bits of 512 locations by testing a pseudorandom sequence, before accepting a memory bank). Try to pinpoint the faulty chip(s) and remove the error.

If it doesn't boot, you're in trouble. I'm sorry. It is difficult to give hints on what to do here. So many possibilities. Desoldering the new chips probably won't work (if the old ones were functional, the ST would still boot). Check for hidden short circuit on the RAM pins. May also be that you have a flaky new pin connection.

RAM DISK FOR THE 1-MEGABYTE ST

atari/tech.st #54, from Gert Slavenberg

To stimulate you to do my 1-megabyte modification, I am distributing a primitive RAM-disk program that will alleviate your needs for a second floppy. The program is currently only runnable on the 1-megabyte ST. It is installed as a desk accessory (load it in at boot time; it stays resident), takes over the BIOS disk I/O vectors, and implements the device driver for drive D. The RAM disk is identical to a single-sided standard 520ST floppy. It is extremely fast; when you put the header files and C source on the RAM disk, compilation takes only the compiler/assembler code load time (± 30 seconds). Loading MicroEmacs is almost instantaneous.

Though I feel a little ashamed at distributing this slightly primitive version, it runs reliably and speeds up my own program debug cycle by a factor of 10 or more. If anyone comes up with a more useful program (e.g., using the terminate and stay resident call instead of wasting a desk accessory, and/or creating an arbitrary size RAM disk with valid file structure), please distribute that in public domain, too.

amiga/main #577, from jsan [Jez San, Argonaut Software]

I have already had my ST upgraded to 1 megabyte of RAM. The upgrade is absolutely vital for serious development use (at least while GEM is still in RAM) because the need to use RAM disks or edit large files requires more than the 200K bytes of memory that remain after you boot.

I might add that although the 1-megabyte upgrade involves considerable soldering, the actual parts cost only about \$50.

Still, the ST is still very much a closed-architecture machine. Just because you can add RAM by opening the case and piggybacking chips doesn't make it an open-architecture machine. There is no inherent way of "memory mapping" an external piece of hardware easily to the ST. You either have to have an 8-bit parallel DMA device (up to 1.33 megabytes/second), or you can memory-map up to 128K onto the cartridge port, with no read/write line. It's a no-win situation! No peripherals can be attached to the ST without their having on-board intelligence to cope with the ST's limitations. As Sig Hartmann says: Our machine doesn't need to be open architecture because we've supplied everything as standard. I don't agree that he is right, but commercially, he has a point. It's a very simple but effective product.

BUGS AND TIPS

atari/tech.st #110, from satether [Steve Tether]

TITLE: Minor Bugs in GEM/TOS

I have had my 520ST for about three months now. Ever since I re-seated the chips on the motherboard the system has been very reliable. There are a few things, however, that annoy me.

1. Whenever I do a Print Screen, either from the menu or with Alt-Help, the time of day in the system clock gets trashed. I'd like to be able to keep the machine turned on all the time so that programs can find out the time and date (e.g., for use in a tickler-file application).
2. If a printer is not connected when I do Print Screen, the system hangs and I must reboot.
3. If I try to delete a file that is read-only, I get a dialog box that "TOS error 1" has occurred. Not very informative.
4. If I create a folder whose name consists of exactly eight characters without an extension, the system refuses to let me put anything into it. It claims that the folder can't be found.

atari/tech.st #111, from jsan:

a comment to 110

All the bugs you mention are common to all normal TOS owners. They have all been corrected in later versions but have not been released yet. The next TOS will probably be in ROM, in at least a month's time, since even if they were to finish it this week, it still takes one month to commit it to masked ROM.

atari/tech.st #116, from neilharris [Neil Harris, Atari Corp.]:

Nov. 13, 1985: a comment to 110

Steve, we are working on a final release of TOS for the ROMs, which should be finished soon. I believe that we will release that version on disk as well. Aside from being somewhat shorter in length (it has to fit into 192K of ROM in the memory map), it clears up all the problems you reported and a couple of others, particularly the heap management problem that results in your not being able to open windows after leaving the system on for too long and using that feature a lot.

atari/tech.st #108, from cheath [Charlie Heath, Microsmiths]

To use multiple dialog boxes on screen simultaneously, the form__do command cannot be used, since it puts program in wait loop for a specific dialog box. Instead, use objc__find commands, but it is important to note that the application must acquire control over the mouse while waiting for user response; otherwise the system will hang up if the cursor is moved into any "sensitive area" (such as window border, menu area, etc.).

Control over the mouse is acquired by using the window update command with proper parameters.

NEW SOFTWARE

atari/tech.st #73

One user tried Hippo-C but found it lacking. The primary problem was the almost complete lack of documentation. Hippo claims full support for the K&R C (except floating point), but several library calls are not there.

For example, how do you allocate dynamic memory? Also, you really need some documentation on GEM, VDI, and AES calls; the manual only gives the routine names, no descriptions even. Second big gripe is that it does not use the GEM interface in any way. The text editor does not even use the mouse.

atari/news.st #89, from bwebster [Bruce Webster, Consulting Editor, BYTE]

I received today the TDI Modula-2/ST package from TDI Software Ltd. in England. After having played with it this evening, I am ready to drop C like a hot rock (not that I'm terribly fond of C in the first place). The compile and link phases are easier and faster than for the C compiler (DRI/Lattice), the editor (included in the package) is the closest thing to

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a Mac-style editor I've seen on the ST (and can be fully driven from the keyboard, for you mousophobes), and it has complete libraries for GEMDOS, AES, and VDI.

I was dreading having to wade through GEM, but now I'm actually looking forward to writing some programs on the ST. The package costs 195 pounds. TDI's U.S. office (they recently merged with Pinnacle) is in Dallas, TX, (214) 340-4941. It produces stand-alone 68000 native-code programs, and it's fast. I'll try to get some benchmarks up here sometime soon, but the graphics demos (which are all working through GEM calls) really zip along, especially the rotating cube (wire-frame, almost flicker-free) and the bouncing lines.

COLOR VERSUS MONOCHROME

amiga/main #623, from bwebster

As far as I know, color software (Neochrome, for example) will not run on the monochrome monitor. If any of you out there know differently, please let me know.

amiga/main #624, from cheath

Programmers must make it work, if they want to. Most of the color software will work in mono, at 1/2 screen width . . . Mono-only software, I don't know what happens in color.

atari/tech.st #109, from cheath

It is possible to detect which type of monitor is present and to write conditional code to work for both in the same program, but the calls are different. It is possible to design a single dialog box that may be used by both mono and color; however, in the 320 by 200 mode the dialog box is twice as large on screen as on the monochrome screen. We have had trouble reading the vertical-sync register; the system crashes when we try it.

atari/tech.st #112, from neilharris

Bruce, Neochrome was written to work only in color—it is a *color* drawing program by design. Other programs like Doodle (a freebie) and Degas from Batteries Included, plus the upcoming GEM Paint and GEM Draw, all work fine in color or in monochrome. It is up to the software.

DOUBLE-SIDED DRIVES

atari/non.tech.st #81, from bwebster

I was able to trade in one of my single-sided drives for a double-sided drive (which, by the way, only holds 709K, not 750+ as someone else reported). I seem to have a little problem, though: Now that I have one SS drive and one DS drive, how do I copy disks?

atari/non.tech.st #84, from jsan:
a comment to 83

Let's assume that you want to copy files from Disk A, which is SS, onto Disk B, which is DS.

First, open up the Destination Drive, which is Disk B. With its window sitting open in front of you, *drag* Disk A's icon (Source Disk) and let go of it while it is over the top of the open window of B (Destination). Once that's done, the files will be copied, one by one. If there's not enough room, or if there are duplicate files, then no matter . . . you'll be kept informed of all things nasty!

atari/non.tech.st #85, from bwebster:
a comment to 84

Ah! You misunderstood my question. I want to make a copy of a given

DS disk, i.e., transfer all files onto another DS disk. I know quite well how to copy files from a DS disk to a SS disk and back; the first thing I did after formatting a DS disk was to *copy* all the files from my two Modula-2 disks (compiler and linker) onto it.

It took forever, too: The ST is not terribly fast when it comes to file-by-file transfers. I'm not sure the ST will let me do what I want to do without unplugging one of the two drives (depending upon which format disk I want to copy).

atari/non.tech.st #86, from jsan:
a comment to 85

Yes, I should think unplugging one of the drives is the quickest way to do it—I can't think of another way offhand!

IBM

This roundup of the activity in the IBM conference features a summary by John Fistere, the conference moderator, of hints for IBM users. Discussions this month include the installation and use of the NEC V20 processor, speeding up the IBM PC AT, and customizing your DOS prompt.

HINTS

ibm.pc/pc.hints #2, from johnf [John Fistere]

A summary of IBM hints from wheelock (Bruce Wheelock) and rmalloy (Rich Malloy, BYTE).

wheelock:

Running programs from a hard disk: In order to avoid the tedious changing directories to get to any program you may have on your disk, write a small .BAT file to do the work for you. Each program you run should have its own .BAT file, and to further keep things organized, these .BAT files and only these files should be in a separate directory named something like \start. (Your autoexec.bat file should have a path statement in it that includes this directory.)

In regard to those batch files, if you put ECHO OFF as the first line in your batch file, you won't have to watch all the commands go by. There is no need, by the way, to put ECHO ON at the end of a batch file. It happens anyway.

My WordStar and Microsoft Word batch files are both set up to do all directory handling, call WordStar/Word, and erase all the .BAK files, if any exist. This is done by:

```
IF NOT EXIST *.BAK GOTO NONE
ERASE *.BAK
:NONE
```

The :NONE, of course, is a .BAT file label. This method keeps me from cluttering up my hard drive with .BAK files, and I don't even have to think about it.

rmalloy offers the following procedures to use SideKick to compose and to receive messages:

I composed this message using Notepad in SideKick. To transfer the message to BIX, do the following:

```
Enter SideKick (Ctrl-Alt)
Write message
Mark the block you want to transfer by using the Ctrl-K-B and
Ctrl-K-K combinations
```

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SOFTWARE • APPLE

Programmable Mac Database Compatible with dBASE III

A programmable database compatible with dBASE III, dMac III lets you transfer applications written in dBASE to the 512K-byte Macintosh. The product has a programming language that lets you create dBASE-type applications. A built-in editor and a professional programming editor let you customize your programs and create your own databases.

The package has an index file that's about 70 percent smaller than in dBASE III

and utilizes 80 percent of the index memory capacity. There are as many as 100 different indexes for files. Maximum database size is 32 megabytes. You can bring up as many as 2000 memory variables and 2000 fields per record; maximum record size is 32K bytes. Up to 32 files can be open simultaneously.

The program requires either two floppy-disk drives or a floppy and a hard disk. Retail price for dMac III is \$495. The software was developed by Format Software GmbH of Cologne, West Germany, and is available from Datalogica, Matrix

Plaza, 1964 Westwood Blvd., Los Angeles, CA 90025, (213) 475-0582. Inquiry 583.

Symbolic Math

BrainPower's PowerMath for the Macintosh solves algebra and differential calculus problems, computes indefinite and definite integrals, solves simultaneous linear and nonlinear equations, computes Taylor series, and performs transcendental and logarithmic functions. You can also use it to solve matrix algebra problems, compute fac-

torials, and plot expressions.

After you type in the problem and select Evaluate, the software calculates the result. You can save formulas and equations as well as the answers from any operation. All problems can be used repeatedly with different variable values.

PowerMath is unprotected and sells for \$99.95. Although simple problems can be handled on the 128K-byte Mac, 512K bytes are recommended. Contact BrainPower Inc., 24009 Ventura Blvd., Suite 250, Calabasas, CA 91302, (818) 884-6911. Inquiry 584.

SOFTWARE • OTHER COMPUTERS

Modula-2, Pascal for Atari 520ST

TDI has developed two packages for the Atari 520ST: a Modula-2 compiler and UCSD Pascal.

TDI Modula-2/ST is accessible from the GEM interface and comes with its own screen editor linked to the compiler. It supports the full GEM interface. Every piece of software written with this Modula-2 is a module and is split into two parts: a definition and an implementation. The definition describes exactly what the module does, which variables and procedures it is importing, and what it is exporting. Implementations of modules can be developed, debugged, and tested. They then become "software chips" that you can use within any software system.

TDI Modula-2/ST costs £195.

UCSD Pascal for the Atari comes with the p-System operating system, which contains the UCSD screen

editor, file manager, and disk-recovery utilities. The compiler is the latest version from SofTech Microsystems and incorporates the key features of the language as defined by Niklaus Wirth, with extensions designed for systems developers and software writers. Among the features are multiple code pools, program segmentation, facilities for building in concurrency, and 36-digit packed BCD arithmetic implemented by long integers.

Contact TDI Software Ltd., 29 Alma Vale Rd., Bristol BS8 2HL, England, telephone: 0272 742796; telex: 449273 TDIUK.

Inquiry 585.

Technical BASIC

TransEra's TBASIC is a technically oriented BASIC for CAD, scientific, and engineering applications, with an emphasis on graphics and instrument control. It incorporates GPIB syntax and is designed to facilitate adaptation of software written for Hewlett-Packard and Tektronix engineering computers to the PC environment. The language runs under MS-DOS, PC-DOS, CP/M, and UNIX.

TBASIC's instruction set conforms to the ANSI proposed standard. Some of the features are cross-reference facilities for listing

variables and referenced line numbers, a command for renaming program variables, MOVE and COPY commands designed to assign new line numbers intelligently, and syntax checking performed as lines are entered.

The language has a full set of binary, scalar, array, matrix, and scientific math functions as well as trig, transcendental, and other operations using both integer and double-precision floating-point data types. It also supports the 8087 coprocessor. Special-purpose array functions perform area, circumference, centroid, and other calculations for polygons.

TBASIC costs \$495 for MS-DOS, PC-DOS, and CP/M; for most UNIX machines, it costs \$795. Contact TransEra Corp., 3707 North Canyon Rd., Provo, UT 84604, (801) 224-6550.

Inquiry 586.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, 70 Main St., Peterborough, NH 03458.

L·E·T·T·E·R·S

COPYRIGHTING ICONS

Your January editorial ("A Threat to Future Software," page 6) regarding Apple's stifling of software creativity was precisely to the point. Legally, I have wondered why Xerox didn't sue Apple long ago. Technically, however, I also wondered why DRI chose to slavishly copy the Mac user interface in the first place.

Take scroll bars, for example. They take up an awful lot of screen space, are difficult to use accurately, and are hardly intuitive, since you need to go *right* first to go *up*! Why not just let a function key cause the cursor to adhere to the first window border it comes to? Option would cause the contents to scroll, Command might cause the window to resize, and Shift would move the window on the screen. Need to close the window? Just move the cursor rapidly back and forth a few times anywhere in the window (a motion similar to using a pencil eraser), and it would be gone. Presto, you have a window that operates far more intuitively than a Mac window, has less screen overhead, less code overhead (no need to draw the bars and resize them), and, best of all, has little resemblance to a Macintosh! And while they are at it, the DRI people might want to throw in support for a global zoom procedure (since every computer screen is only a window on an application) and the global abort function that the Macintosh sorely needs but doesn't have.

ALEX FUNK
Durham, NC

It is truly remarkable that Apple managed to copyright the garbage can (its primary symbol?) and the icon interface developed by Xerox.

It must be in the general interest to have a standard set of icons that express their meaning clearly and unambiguously.

Clearly, Apple is taking the necessary steps to prevent a natural development of such a standard. Is Apple trying to prevent other vendors from launching systems based on the ideas from Xerox? Do the people at Apple really think they will succeed? That is difficult to believe, as the bit map of an icon hardly is the major feature of a computer system, and more powerful machines will appear in the near

future, easily outperforming the Mac in all aspects (except the garbage can).

GÖRAN RYDQVIST
KJELL POST
Linköping, Sweden

When I first learned that Apple had won a decision against Digital Research for "visual copyright" infringement, I thought "Right on!" and still feel this way. A programmer should be able to protect his rights to any commercial system he develops. We would all agree that the visual aspects and appearance of any software system contribute heavily to the success of that particular system in the marketplace. Your line of reasoning to justify other persons' ignoring visual copyrights—the "incremental" theory—if carried to its logical conclusion in my mind leads us to the point where my firm could publish a new software release called Wordstar 5000, emulating the latest MicroPro screens for its fine word-processing program. As long as we could prove incremental improvements, we would be protected from (not liable to) suit by MicroPro. This is ridiculous! It is the programmer's right to release newer, incrementally improved versions of any software product he has authored. If another firm feels it has a dynamic idea for an enhancement to an existing piece of software, then isn't that what joint ventures are for?

The computer industry is far away from the ideal man-computer-man interface. Let us collectively stimulate, encourage, and suitably reward those who pursue new, untried interface techniques. As the level of computer literacy rises above thinking of the computer as a car-type tool and reaches the level where we see the computer as an extension of our brains, we will all probably want our own individualized interfaces.

MIKE CARMICHAEL
Glasgow, KY

COVERING ATARI'S ST MACHINES

Well, another month has come and gone, and the only mention made of the best low-priced computer on the market is a few slightly snide remarks. I can't say that I am totally surprised, since it took BYTE

a few years to figure out what every Atari owner knew—that the Atari 400/800/1200s were the best 8-bit graphics machines on the market.

Now comes a new Atari, the 520ST. It is available everywhere, right now, with software delivering now. Also available is a complete developer's software/documentation package for less than a good C compiler for the IBM PC and its look-alikes. Still, no real mention in BYTE. Methinks your biases are showing.

I will readily concede that the Amiga is probably a better machine, but at a price that is more than double that of a similarly equipped 520ST. Mr. Webster and others have said the 520ST is not expandable. Officially, that's true. But, as many owners of the Atari 400 know, the 400 wasn't expandable beyond 16K RAM, officially. I and many others have or had 400s with 48K within a year of introduction. My 520ST (remember, unexpandable) will shortly have 1 megabyte of RAM (cost: less than \$70) and an add-on 80-track 5¼-inch drive. So much for officialdom.

When I bought my machine, I received BASIC, Logo, Neochrome (graphics drawing program), and ST Writer (word processor). While the graphics and word-processing software are not up to some of the more mature applications, they are far from primitive.

In my area, the Amiga is not available yet, but it will be in "real soon now." The dealer says there is lots of software for the Amiga, but he doesn't have any in stock; again, it will be here "real soon now." I don't know about you, but in the computer world "real soon now" can often take months or years.

(continued)

LETTERS POLICY: To be considered for publication, a letter must be typed double-spaced on one side of the paper and must include your name and address. Comments and ideas should be expressed as clearly and concisely as possible. Listings and tables may be printed along with a letter if they are short and legible.

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LETTERS

As for comparing machines, we really have to compare machines that are similarly priced. With the Atari 520ST's \$1000 price tag, that leaves the Apple II. Poor Apple. When comparing compatibility, then we have to look at the IBM PC/XT/AT and the Amiga. The PC/XT/AT's saving graces are manufacture by IBM and a large base of available software. I recently saw a benchmark on the 520ST for processing (primes). Nothing that anyone will buy for home use was anywhere close to Atari's speed.

For business, I don't really believe that the Atari will penetrate the market with any great percentage. Its success will probably be along the line of the Apple Macintosh. It offers more bang for the buck than any other currently manufactured machine.

For support, Atari was always one of the better companies about supplying information and help with its machines. Also, there is a very large installed base of users that are buying up the 520STs as fast as they hit the retail store. Some public-domain software is already out there. Admittedly, it is not at the level it will be in a very short time. Also, there are two Atari-specific magazines on the market that are publishing more and more information about the machine every month.

BYTE, your prejudices are showing, and by this letter you can see that mine are showing also. Maybe it will balance out.

LLOYD PARSONS
Herrin, IL

Phil Lemmons replies:

We are not prejudiced against Atari or any other company. We were hampered in covering Atari's 520ST by the company's refusal to give us access to a machine despite repeated attempts on our part. But that problem is now past. Please note that our January, February, and March issues all contain coverage of Atari's ST machines.

I'D KNOW THAT CHIP ANYWHERE

I don't know whether this is a coincidence or not, but a chip virtually identical to the one John Bennett has described ("Raster Operations," November 1985, page 187) was developed by myself and John Atwood at Silicon Compilers in early 1983. The chip, designed with the help of an early version of the Silicon Compilers software, has been used quite successfully in the Sun Microsystems Color Workstation. In this application, a total of eight RasterOp chips (one per bit plane) manip-

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is the lack of graphics hardware standards. If you write for a Motorola 6845 video controller, it won't run on machines using any other controller. You can, however, write subroutines or procedures in assembly language to be called by high-level-language programs if you can write the CP/M drivers to begin with.

Using an RGB monitor is possible in the Apple II only if you have an accessory board that provides that capability—hardware limitations again.—Steve

MYTHOLOGY

Dear Steve,

I see relatively few letters and articles pertaining to Atari computers in BYTE. I thus have been unable to find out more about the similarity between the Atari and the Apple, especially since it is well known that the original Apple was built out of an Atari. Has anyone repeated this feat? If so, where could I go to upgrade/emulate the Apple with my Atari 800XL?

SUE PAOLINI
Hoboken, NJ

Like many things that "everyone knows," this one just isn't true. Apple Computer was formed in April of 1976 to sell the original Apple kit. In June of 1977, the company ran its first ad in BYTE for the Apple II, of which today's Apple IIe is a variation. Atari announced its first computer in December of 1978, but it did not become available until late 1979.

Even though Apple and Atari use the same processor, nearly everything else (ROM, I/O, graphics, etc.) is different. Emulating an Apple on the Atari is theoretically possible but would be very difficult. I have not been able to locate any product to accomplish this.—Steve

TNT

Dear Steve,

I have a TNT, and I've tried a few times to interface it to my IBM PC. My PC has

IBM	1	-----	1		
	2	-----	3		
	3	-----	2	TNT	
	4	-----	5		
	5	-----	4		
	6	-----	20		
	7	-----	7		
	8	nc	8		
	20	-----	6		

Figure 1: The diagram for construction of a null-modem cable.

an internal Qubie modem with a serial port. I made a few attempts at building a connection, but whenever I ran a program in BASIC, I got the error message "device time out."

ITSHAK MIHAELI
Staten Island, NY

There are several possible reasons for your troubles. First, be sure the serial port in the Qubie board is connected as COM1:. If it is COM2:, use the OPEN COM2: statement in BASIC on the IBM side to open the serial port. Also, make sure both computers are set to the same data-transmission rate.

Next, be sure you have connected the two computers as shown in figure 1. This arrangement is called a null modem.

If you are already using this arrangement and your cable has no bad connections, you should test each port with a loopback plug to find out which one is causing the problem. A loopback plug is a DB-25 (RS-232C) connector with the following pin pairs connected together: 2 to 3, 4 to 5, and 6 to 20. This plug makes the computer send data to itself and can be used to test each computer's serial port for proper function.—Steve

CHIPS

Dear Steve,

With the recent sharp price cuts in 256K-bit RAM chips, it seems that replacing the 4164s on the motherboard of an IBM PC or a Compaq would offer many advantages over an add-on memory board. I've heard that the 41256 chips can be substituted in some cases, but I don't know what sort of trace cuts or jumper settings might be required. Can you help?

BRIAN UNDERDAHL
Ballwin, MO

The 256K-bit 41256 chip pin-out is identical to the 4164, except for pin 1, which is NC on the 4164 and address A8 on the 41256. This allows 9-bit row address by 9-bit column address. The IBM PC has no provision for implementing the pin 1 address, and I don't think the Compaq does either.

Changes on the board required to make this swap with jumpers would be extensive but probably not impossible. There were a couple of companies converting the early IBM 16K- to 64K-byte motherboards to use 64K-bit chips for 256K bytes total on the motherboard. Maybe someone will offer a similar service for the 256K-bit chips now that the

(continued)

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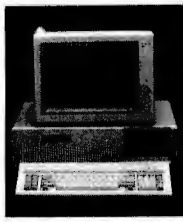


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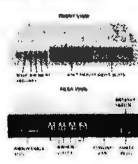
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prices are down.

The advantages may not be as big as they first appear, however, because almost everyone wants a battery-backed clock/calendar and one or two serial ports, etc. This being the case, it is usually economical to buy one of the multifunction expansion boards that provides these, along with 384K bytes of memory. MS-DOS won't allow easy use of more than the 640K bytes this provides.—Steve

PC AND VCR

Dear Steve,

I plan to buy an IBM PC or a PC-compatible microcomputer. I would greatly appreciate it if you can cite any references that show how to interface it to a video-cassette recorder.

P. L. K. SASTRY
Bombay, India

The July 1984 issue of BYTE contains an excellent article on interfacing a video-cassette recorder to the TRS-80 Color Computer. "Computer Control of a Video Recorder" by Cy Tymony (page 179) describes the hardware and software necessary to control a VCR with any computer capable of generating sound. The same issue of BYTE also contains articles on interfacing videodisc players and Interactive video programming.

Once you can control your VCR from your computer, you may want to use your computer to capture and modify video images. Chorus Data Systems (6 Continental Blvd., POB 370, Merrimack, NH 03054) sells hardware and software for the IBM PC that allows you to capture video data and save it in your PC. Photo-base software from Chorus Data Systems lets you create a database containing both text and digitized video information.—Steve

ATARI HOME CONTROL

Dear Steve,

How plausible is it to convert an Atari 2600 to a home controller, monitor, and security system? It seems to me that the 2600 has suitable graphics, I/O, and such to do so. Is it possible to do it through the ROM cartridge connector? Has anyone published specs and schematics for the machine? It seems that it would not be difficult, knowing the memory map, switches, and resident routines, to build a piece of hardware to use this machine. The firmware could be developed on another machine. I have in mind applications like laboratory monitoring, robotics, weather

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monitoring, security, and climate control. I would buy your designs, but I am a medical student living on borrowed money, and the Atari 2600 is cheap.

SAM HUNTER
Galveston, TX

There are several good reasons not to use an Atari 2600 game machine as a home controller. The RAM and I/O capabilities are limited, and a second computer would have to be used for software development. Also, specs and schematics are available only to service centers; you may have a difficult time getting them.

Why not use an Atari 400 or 800? You can often find a used machine in good condition for as little as \$25 that would provide a programming language and excellent I/O capabilities. Documentation, information, and finished products are readily available. You might want to refer to "Control Your Environment with the Atari 400/800" by David Alan Hayes (July 1983 BYTE, page 428).—Steve

SCIENTIFIC DATABASES

Dear Steve,

I would like to know where addresses of Canadian and American scientific databases are available. Technical databases in the field of graphic arts in connection with CAD, CAE, and CAM are especially important to me. Thanks.

CLAUS STERNBERG
Salzburg, Austria

The October 1984 issue of BYTE contains the article "Low-Cost On-Line Databases" (page 167). The author, Matthew Lesko, publishes a monthly newsletter that lists current free and low-cost databases. Contact Information USA, 4701 Willard Ave., Chevy Chase, MD 20815, (301) 657-1200.—Steve ■

IN ASK BYTE, Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to

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THIS MONTH, BYTE PRESENTS a preview of Atari's new \$999 1-megabyte machine—the 1040ST. Although the system is similar to Atari's 520ST, it has twice the memory capability, an internal double-sided disk drive, an empty socket for a graphics coprocessor, and it is the first computer to begin its retail life at a cost of less than one dollar per kilobyte. The article also includes an interview with Shiraz Shivji, Atari's vice president of research and development, who discusses the company's plans for the future.

In "Finding the Titanic," Marti Spalding and Ben Dawson take a look at the state-of-the-art image-processing equipment used in the underwater exploration that located the sunken *Titanic*. The ship was lost in the Atlantic for 73 years until teams of French and American researchers, with millions of dollars worth of equipment, were able to pinpoint the wreck.

In Ciarcia's Circuit Cellar, Steve offers us a choice of real-time clocks. The first one uses a CMOS chip that you attach to the computer through parallel ports. This conventional approach appeals to those who want a quick resolution of a problem. The second clock uses a unique concept that Steve believes will prevail long into the future. It uses a new clock "socket" that requires no independent interfacing and merely plugs in with a static-RAM chip.

The Programming Project is the first of a two-part article by Bruce Webster. Bruce mentions that windowing systems can be and have been implemented on most of the more "mundane" computers. The goal of his article is to show you how to do this. In Part I, Bruce covers basic principles and examines the problems involved in opening a window.

As C has become more popular among developers and programmers, it has become necessary to establish a standard to keep C programmers working with the same language. "An ANSI Standard for the C Language," by Steve A. Hersee and Dan Knopoff, describes the standard that has been proposed by the ANSI Standardization Committee and invites participation in establishing the standard.

This month's Programming Insight describes a disassembler program. In "Macintosh Explorer," Olav Andrade explains that when using a Macintosh he discovered that the Toolbox/Operating System routines would be vital to his applications. His problem was that he needed to know how the Toolbox calls were made and Macintosh Explorer was his solution. It is written in Microsoft BASIC for the Macintosh.

THE ATARI 1040ST

A megabyte of memory for \$999

Editor's note: The following is a BYTE product preview. It is not a review. We provide an advance look at this product because we feel that it is significant. A complete review will follow in a subsequent issue.

Atari's new \$999 1-megabyte 1040ST (see photo 1) establishes a price break reminiscent of the Commodore 64's. And, as table 1 shows, the 1040ST will be the first computer to begin its retail life at a price that represents less than one dollar per kilobyte. The 1040ST is clearly a bargain, with over 1 megabyte of RAM (random-access read/write memory), its operating system in ROM (read-only memory), an internal 720K-byte double-sided drive, an internal power supply, and the same features and functionality that already make the Atari 520ST an attractive purchase. [Editor's note: See "The Atari 520ST" by Jon R. Edwards, Phillip Robinson, and Brenda McLaughlin, January BYTE, page 84.]

SYSTEM DESCRIPTION

Our coverage of the 520ST adequately describes most of the features of the 1040ST (see also the "In Brief" box on page 86). The new computer has the same keyboard, the same ports (although these are now in new locations, see photo 2), and the same architecture. We remain uncomfortable with the keyboard, but the keytops are removable. We suspect that

some speedy entrepreneur will provide alternative tapered keys for the ST machines.

The most obvious changes are cosmetic: The keyboard/computer unit is 2 inches deeper and 4½ pounds heavier than the 520ST, and the keyboard provides a much more substantial feel. The mouse/joystick ports are now located under the bottom right front of the unit, a significant improvement for left-handed users.

A number of changes are more than cosmetic. The internal power supply eliminates two of the external power supplies needed by the 520ST (wire haters rejoice). We left the unit on for five days and experienced no difficulties with overheating. There is no internal fan, but the unit appears to adequately dissipate heat. The internal disk drive supports both single- and double-sided disks. An RF (radio frequency) modulator will allow you to hook up the 1040ST to a television set; you might, therefore, obtain the high-resolution monochrome system for word processing and programming without sacrificing the use of low- and medium-resolution color. However, we received a preproduction unit lacking the RF modulator that will accompany the final product; therefore, we were unable to test the television quality of the computer's output.

The megabyte of RAM in the 1040ST isn't crammed into the case. The 520ST uses a custom Memory Controller chip to handle its sixteen 256K-byte dynamic RAM chips. The 1040ST uses the same Memory Controller. Because the controller can handle 32 RAM chips at a time, the

Atari engineers simply had to find room for 16 more 256K-byte dynamic RAMs on the 1040ST circuit board to pump RAM capacity to a full megabyte (see photo 3). In fact, the Memory Controller can also govern 1-megabit dynamic RAM chips. Atari should have little difficulty designing an ST with 4 megabytes of memory.

Undoubtedly, the most interesting addition to this computer, apart from the extra memory, will be an empty socket for a graphics coprocessor. Our preproduction unit also did not include the socket, and it may not be offered with the first releases of the 1040ST. Phil Robinson discussed this and Atari's future plans with Shiraz Shivji, vice president of research and development for the company (see the text box "An Interview with Shiraz Shivji" on page 90).

TOS IN ROM

With TOS (the operating system for both the 520ST and the 1040ST) in ROM, the 1040ST boots more quickly than the 520ST. [Editor's note: Atari is currently supplying the ROM chips to 520ST developers and will be making the chips available through users groups.] Booting with a nonsystem disk takes less than 6 seconds, down from 37

(continued)

Phillip Robinson is a senior technical editor, and Jon R. Edwards is a technical editor for BYTE. They can be contacted at BYTE, POB 372, Hancock, NH 03449.



Photo 1: *The Atari 1040ST.*

IN BRIEF

Name

Atari 1040ST

Company

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Price

With monochrome monitor, \$999
With color monitor, \$1199

Microprocessor

Motorola 68000, a 32-/16-bit microprocessor (32-bit internal architecture with 24-bit, nonsegmented, external data bus) running at 8 MHz

Main Memory

1024K bytes of dynamic RAM

ROM

192K-byte TOS in ROM, not including the desktop accessories

Graphics

Three modes: 640- by 400-pixel monochrome, 320 by 200 with 16 colors, and 640 by 200 with 4 colors

Sound

Three independent sound channels from 30 Hz to 125 kHz

Floppy-Disk Drive

Internal 3½-inch double-sided double-density drive with capacity of 720K bytes. System supports maximum of two floppy-disk drives.

Keyboard

94-key Selectric-style QWERTY keyboard with numeric keypad, cursor controls, and rhomboid function keys

Interfaces

MIDI in and MIDI out ports
Monitor port (supports RGB analog, high-resolution monochrome)
RF modulator
Centronics parallel printer port (supports Epson-compatible printers)
RS-232C serial port
Floppy-disk port
Hard-disk port (10-megabit-per-second DMA transfer rate)
128K-byte ROM cartridge port
Ports for mouse or two joysticks

Bundled Software

Atari Logo
ST BASIC

Optional Peripherals

SF354 single-sided drive
SF314 double-sided drive

Planned Expansion

Graphics coprocessor, SMM801 dot-matrix printer, SDM121 daisy-wheel printer, 10-megabyte fixed disk, 8-slot expansion interface, CD-ROM, local-area network for MIDI port

seconds on the 520ST. After booting, the color system displays blue and yellow crossbars instead of the multicolor display shown on the 520ST. The desktop icon also appears in much brighter green on the 1040ST, which Neil Harris of Atari explains is more effective on color television screens for those who will make use of the RF modulator.

Although it increases the time to 17 seconds, you may prefer to boot with a nonsystem disk that includes the desktop accessories. By so doing, you can maintain access to the Control Panel (to change the background color, for example), the RS-232 Port Configuration, and the Install Printer facilities. You also have the option of placing the operating system (38 seconds), and presumably any alternative operating system, into RAM.

The ROM TOS appears to be functionally identical to the first release of TOS in RAM, but there have been some additions. In the interest of supporting business applications, the ROM TOS raises the limit on open files from 30 to 100. A new dialog box informs you if you have insufficient memory to run an application. The earlier versions of TOS simply return you to the desktop. Two new GEM functions, `form__button` and `form__keyboard`, will allow developers to bring up dialog boxes without freezing the current application. You could, for example, postpone your response until you finish a task.

Most of the other changes involved crunching the code from over 200K bytes to 192K bytes (Landon Dyer, software design engineer for Atari, reports that the production ROMs are a mere 14 bytes short of 192K bytes), but there have also been a number of modifications and corrections, many in response to the experiences of ST developers. Early versions of TOS did not allow you to print from the desktop if you set your printer to the serial port. Now you can. Full type-ahead buffers will no longer eat characters. And icon grabbers can take comfort in the fact that rapid movements of icons into the

menu bar can no longer crash the system.

A SAMPLE SESSION

We obtained similar results on BYTE's standard benchmark tests for both the 520ST and the 1040ST. Using ST BASIC (see photo 4), both machines ran the Sieve of Eratosthenes in 85 seconds and the Calculations benchmark of 10,000 multiplication and 10,000 division operations in 32 seconds. Both formatted single-sided disks (357,376 available bytes) in 54 seconds. The 1040ST took 102 seconds to format a double-sided disk (726,016 available bytes). It took 16 seconds with the 520ST to transfer a 40K-byte file from one single-sided

drive to another. It took 17 seconds to transfer the same file from the 1040ST's internal drive to an external single-sided drive.

In conducting the tests, we had two small problems. First, when we connected an external single-sided drive and took a directory of the internal drive, the 1040ST appeared to poll both drives. We got the directory we requested, but the fact that the internal drive is so quiet made it seem that we had inadvertently addressed the external drive. The whirring of the external drive was a continual annoyance.

Second, Atari's ST BASIC reserves approximately 160K bytes to buffer graphics, store arrays, and so on. On

the 1040ST, with TOS in ROM and when booting with the desk accessories, you still obtain a workspace in excess of 700K bytes. On the 520ST, with TOS in RAM, we obtained a workspace of only 5K bytes. To run the Sieve, which dimensions an array to 7000 elements, we had to boot without the desk accessories (a savings of about 30K bytes), eliminate graphics buffering (an additional savings of 32K bytes), and dimension the array as an integer array. Using a real array, the 1040ST ran the Sieve in 90 seconds.

SOFTWARE

The earliest critics of the 520ST bemoaned the lack of software, but the

(continued)

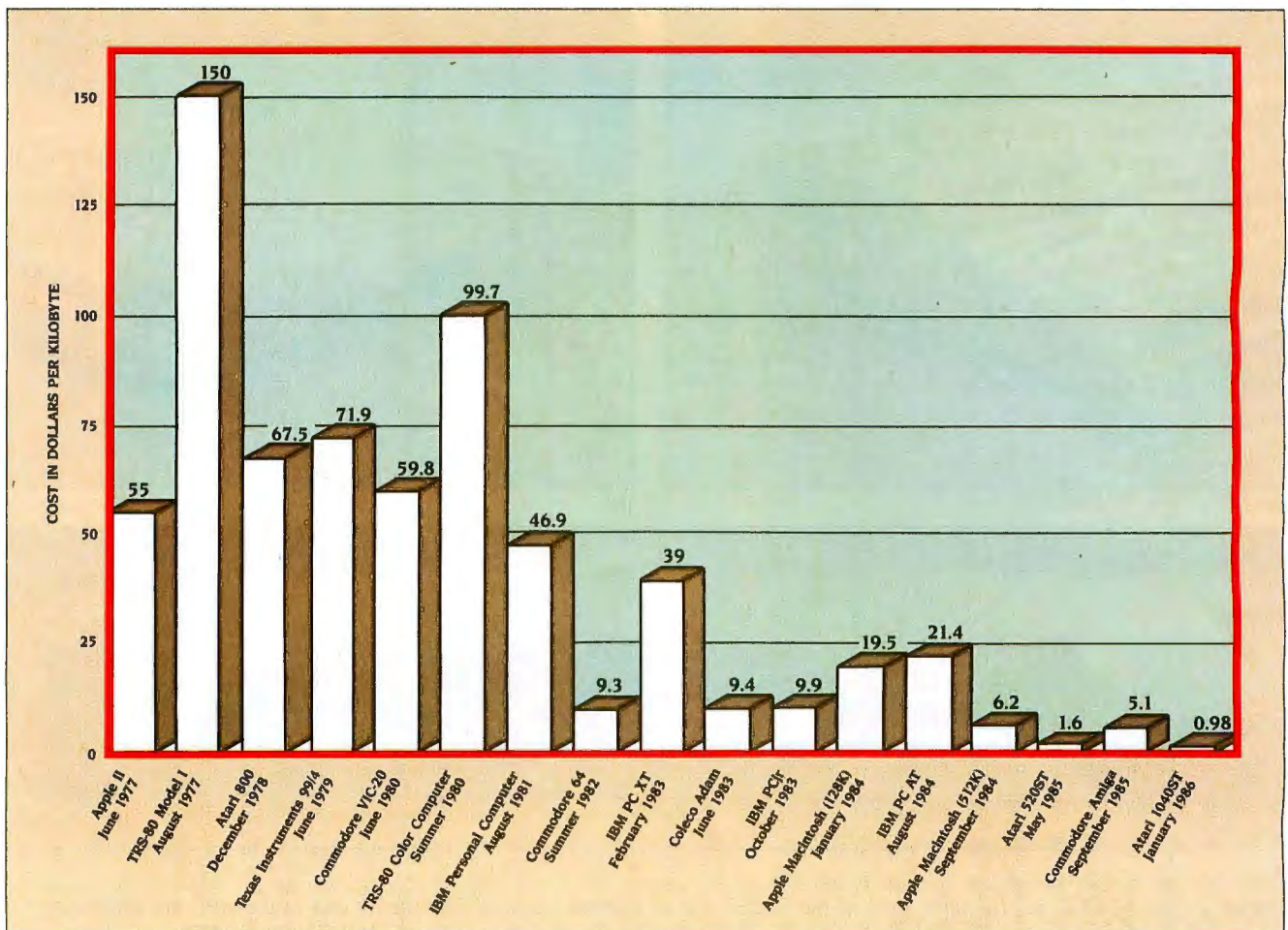


Table 1: The Atari 1040ST is the first computer with an original list price that represents less than a dollar per kilobyte. The price-per-kilobyte figures were determined by using the original list price for each system on the chart. Prices reflect those for the original system configurations; many but not all of the systems were originally bundled with disk drives and monitors.

list of available packages has grown and is still growing. The major criticism left is that most of the early products are ports that don't take advantage of the ST's full capabilities. A significant exception is DEGAS from Batteries Included, a full-featured paint package that makes the color monitor worth having (see photo 5).

For those of you who are anxious for information about available software: Michtron has a variety of utilities for the ST machines, including a printer spooler, a RAM disk, and terminal software. SST Systems has Chat, version 1.2, a terminal program with support for XMODEM. A variety of word processors are available, including Mince and Final Word from

*For some time, the
Atari 1040ST will be
the clear leader
in price/performance.*

Mark of the Unicorn, Express from Mirage Concepts, Haba Writer from Haba Systems, Regent Word from Regent Software, and both 1st Word and ST Writer from Atari. The last of these is in the public domain. DB-Master One from Atari, Hippo Simple from Hippopotamus Software, and Zoomracks from Quickview Systems

are database managers. Regent Software also offers a spelling checker with full GEM features. VIP Systems offers The Professional, a Lotus-like spreadsheet. And XLENT software offers Typesetter ST, which supports DEGAS and Neo formats and Pro-writer, NEC, and Epson printers.

CONCLUSION

The 1040ST has a remarkable price, and for some time it will be the clear leader in price/performance. Moreover, the graphics coprocessor chip may convince skeptics to take a second look at the ST. Some of our criticisms of the Atari 520ST remain: The desktop is less effective than the

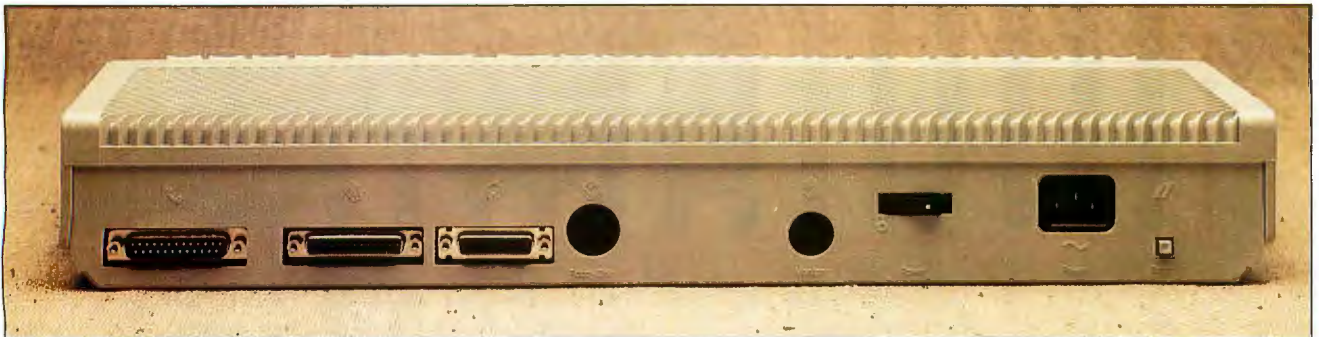
(continued)



(a)



(b)



(c)

Photo 2: The 1040ST has the same ports as the 520ST, but in different locations. The joystick and mouse ports are underneath the right front of the unit. (a) The disk drive is on the right side. (b) On the left side are the MIDI out and MIDI in and the 128K-byte ROM cartridge port. (c) From left to right on the back panel are the RS-232C serial port, the 25-pin Centronics parallel printer port, the DMA (hard-disk) port, the floppy-disk port, the monitor port, the on/off switch, the AC power connector, and the reset button.

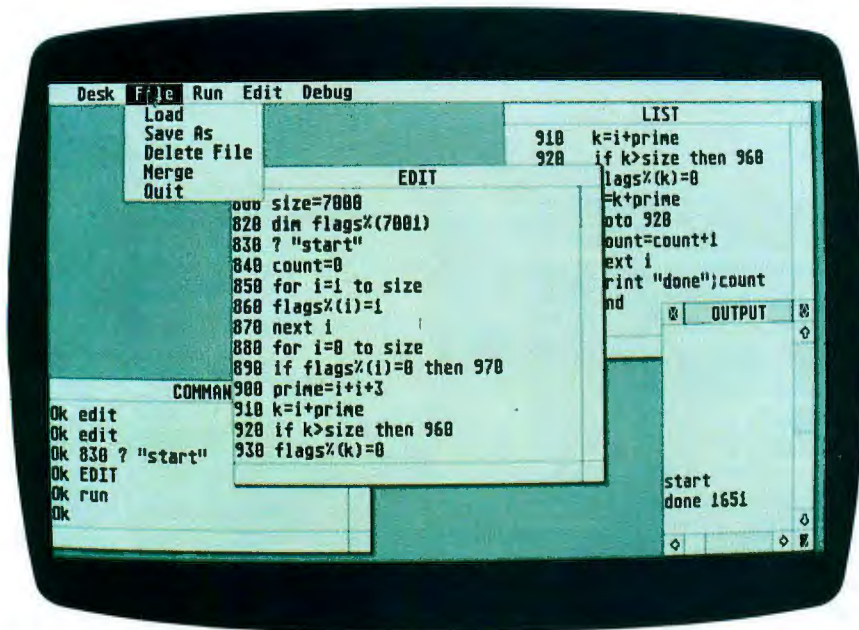


Photo 4: The Sieve of Eratosthenes in ST BASIC. The screen shows the high-resolution monochrome display.

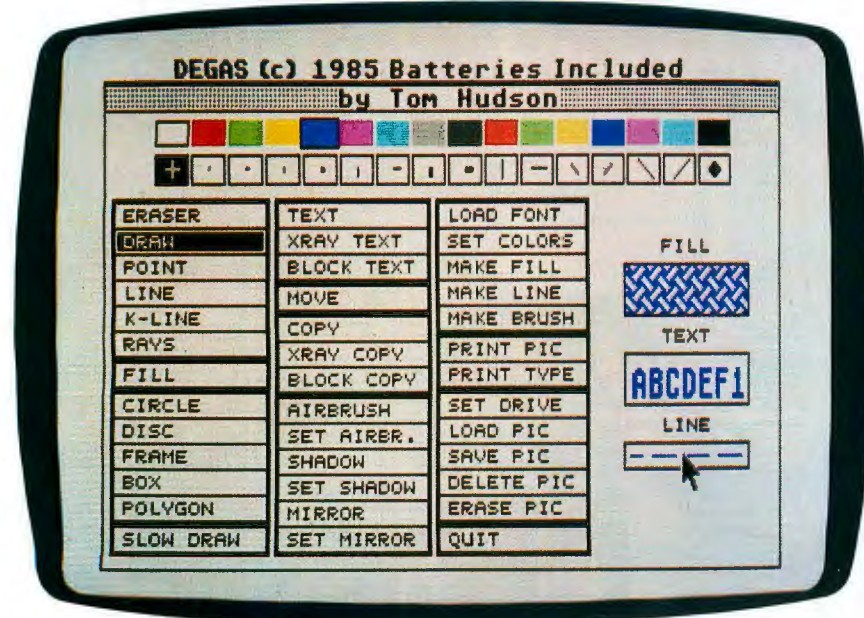


Photo 5: The main menu of DEGAS, a deluxe paint package from Batteries Included, in low-resolution color graphics.

Macintosh's and the keyboard has an awkward feel. But the 1040ST addresses most of our concerns. It will have an RF modulator, the power supply is internal, and TOS is in ROM. And given the outstanding price, our

overall impression is even more positive.

Who knows, perhaps the next price break will be on Atari's coming efforts: 2- and 4-megabyte machines and 640- by 592-pixel graphics.

Editor's note: This text box contains portions of Phil Robinson's December 1985 interview with Shiraz Shivji, Atari's vice president of research and development.

THE GRAPHICS COPROCESSOR

BYTE: Tell us about the graphics coprocessor. When will there actually be a socket waiting for it in the machine?

Shivji: That's up to the marketing people, but perhaps by April or May. I really am pushing for the machines to be upgradable—at least to have sockets—and it may not happen in the first machines. As far as the engineering is concerned, we have some artwork in the 1040 footprint ready to go that has the socket for it.

BYTE: How far advanced is the design of the chip?

Shivji: We're running checks on the layout right now. We expect to see parts by the end of January [1986].

BYTE: It's not going to be an expensive addition?

Shivji: No, very inexpensive. You'll only need to put in the coprocessor and change the ROMs. It's not a simple part, it's quite complex. That's why we waited until now to get it out. But it's going to be fairly inexpensive. We're doing it in a 2-micron, double-metal CMOS [complementary metal-oxide semiconductor] process, which is the latest process you can get.

BYTE: What kind of power will it add and how?

Shivji: Some of the screen operations will become about 20 times as fast.

BYTE: What kind of screen operations? Like blitting one area over another?

Shivji: Yes, it does fairly sophisticated blit operations. I believe we have some nice features that some of the other blit chips don't have. The problem with some of the other blit chips is that the way they glue to the bus is not very good. I have a blit chip from an outside vendor right now that has just

AN INTERVIEW WITH SHIRAZ SHIVJI

CONDUCTED BY PHILLIP ROBINSON

come out, but the chip needs a lot of glue around it; in fact, it needs external counters and so on. I would say we do as much as what's in the Amiga chip, and we have some things in it that make it nice in the way it fits on the bus. The cleanliness of the architecture is very important to us. It's a 68-pin PLCC [plastic leaded chip carrier] part. It sits on the bus. It's benign unless it's activated, and then it comes over and takes the bus. But again, a lot of the things like the DMAs [direct memory accesses] are not affected because the DMA will preempt the chip; it has the same priority as the processor.

BYTE: *How does it share time with the processor?*

Shivji: It takes over stuff from the processor, but it doesn't hog it completely. We allow the processor to have a few cycles.

BYTE: *How many gates? Is it a gate array or will it be a fully custom-designed chip?*

Shivji: It will be a fully custom chip. As far as complexity is concerned, I would say it's around 20,000 transistors, so it's medium complexity. One of the things that is important in any design is how you partition things. I feel we have the best partitioning, as good as you can get. And again, it's like the early days of computers where things were hard-wired and the concept of having sub-routines came along. That was a tremendous breakthrough—to be able to modularize stuff. This is what I feel we've done on the ST. We are modular. For example, the blit is completely coordinate-free. We will use the same part in the new version of the ST, which is high-resolution. So, it's nice the way we can do those kinds of things and not have it tied to the machine.

EMULATING THE IBM PC

BYTE: *The V20 board that's in the lab for emulating the IBM Personal Computer—is that experimental?*

Shivji: No. We will actually show it at an upcoming CES [Consumer Elec-

tronics Show]. In fact, we can either run an 8088 or a V20. We're running it at 8 MHz, and we're going through the DMA channel to get the speed for the display.

BYTE: *You're going through the DMA channel, so this is going to be an external board in a little box?*

Shivji: It's a self-contained box with its own power supply. It will have quite a bit of its own memory. It has the 8088. It also has an 8253 because a lot of people go directly to the timers in the IBM PC. But the problem in any kind of an emulation is the speed of scrolling things on the screen because you have to effectively reproduce what is being done in the PC environment into something else, and it's very slow. We don't think it will be that slow in the case of the ST. Our graphics modes are a superset of the IBM PC's anyway.

BYTE: *Are you using some BIOS [basic input/output system] from an outside source?*

Shivji: Actually, we have the work done on a machine that provides IBM PC compatibility with the 800XL. Initially there was an Atari project that was compatible with the IBM PC, the Apple II, and the 800XL. They eventually abandoned the Apple II compatibility, but they made it compatible with the 800XL. We're essentially following from that effort; we're using a lot of software from that era.

FUTURE MACHINES

BYTE: *Will the next machine be 2 or 4 megabytes?*

Shivji: We are using the base architecture for future machines. We will have a 2-megabyte version out fairly soon, perhaps in the same case. As you know, the chip is designed to handle 1-megabit parts. If 1-megabit parts are in sufficient quantities, then today we can use sixteen 1-megabit parts; that's a 2-megabyte machine. And if you use 32 parts, which the chip is designed to handle. . . .



BYTE: *You'd just need to have a new board layout, drill new holes.*

Shivji: Yes. And as a matter of fact, it would be easy to upgrade a 1040. . . . 1-megabit parts are 18-pin parts. It would not be that difficult to upgrade your 1040 to make it a 4-megabyte machine by using 1-megabit parts.

BYTE: *How would you do that?*

Shivji: You have two banks, you'd have to remove the chips, but you could do it because it's not that difficult. In fact, we have built a prototype with 1-megabit parts.

CHOICE OF THE 68000

BYTE: *About the 68010 and the 68020. You were saying that the 68010 didn't improve ST performance that much.*

Shivji: Not as much. We designed the ST in part as a front end for a compute engine through the DMA channel. That's where we're going to put our compute engine, whatever it is. The people that have bought STs and are buying STs in the future will have the capability of expanding painlessly and using their existing peripherals and everything and get on to a full 32-bit machine such as a 68020.

(continued)

BYTE: So you're thinking more in terms of a box out back with a 68020 in it and not of an internal 68020.

Shivji: Yes. We now know how to do a good job in putting a 68000 as part of something that drives video displays in various modes. In fact, we have not run out of steam yet as far as bandwidth of data is concerned for even displays that are 1024 by 1024. We think 1987 is approximately when we might have another generation of machines where the base I/O [input/output] driving the video, and so on, may not be enough, especially if you're talking about 4 to 8 planes of 1024 by 1024. Then you need something like a 68020. But even that is not enough. You couldn't run just raw 32-bits. You would probably have 64- and 128-bit-wide data paths to take care of all the planes that you're talking about.

We have the architecture sketched out; we are doing the custom parts for it. By the way, these parts are fully custom. Some of the chips we've met are really huge. You wouldn't be able to do it even with semicustom. You certainly could not use gate arrays; there's no gate array built at the moment that can handle one of the chips we're talking about. It would be the equivalent of about 25,000 gates. It's also very high speed. We're looking, in some cases, to run things at about 100 MHz.

BYTE: Do you have to go to bipolar then in the custom chips?

Shivji: We will actually have custom chips at 2-micron, double-metal CMOS. But then there's going to be an interface chip to drive external things. The reason we can go to high speeds is because the structures we're using are very regular. There's no loading. Supposing you run a shift register. There's no loading in between cells. All you're doing with a flip-flop cell is driving another cell, and so on. You can get quite a bit of performance if you use such a structure, and we're using a similar structure.

BYTE: And when you're at 2-micron, too.

Shivji: Yeah, 2-micron double-metal is quite fast. So we can run close to 100 MHz, but only on a small section of the chip. Everything is not running at that speed.

CD-ROMS AND FLOPPIES

BYTE: What about the disk memories? the CD-ROM?

Shivji: We're waiting for audio. The first version of the CD-ROM players was a small unit; the power supply was a separate box. The second batch has a built-in power supply. Now Sony has a third batch, starting around April, which has audio as well as digital. That's the one that we're waiting for. We feel that if a customer spends \$600, he might as well have audio, too.

BYTE: What about the floppies? Is there going to be a change at some point, going to higher densities, 1.2 megabytes?

Shivji: Two megs is almost here. The thing that's going to be important is the media, because it is special media that can handle 2 megs. Some of our Japanese friends who are drive manufacturers are working on a 10-megabyte floppy in the 3.5 format. They think that sometime around mid to late 1986 there will be 10-megabyte drives.

MULTITASKING

BYTE: What about multitasking? When will that be coming as an option, or do you see that as necessary at all?

Shivji: To get useful multitasking you have to have things like protection, which is not the case in many existing machines. Although we have protected space, as you've noticed, it's not very much. The architecture is there to provide more protection, and in future versions of the machine we may provide a lot more protection.

BYTE: That's why you're looking at the memory-management chips and such?

Shivji: Yes, we're looking at memory-management chips, but doing logical-to physical-address translation is perhaps not as important as the protection feature for multitasking. So we're looking closely into protection. Again, the future versions of the ST architecture could have more; we have only 2K bytes at the moment, and we could probably protect about half a megabyte. And then that would make it a lot easier to run a protected kernel and then multitask.

BYTE: What about UNIX System V?

Shivji: We're looking at System V now.

We're constantly looking at multitasking, and we're constantly getting proposals for a multitasking environment. As a matter of fact, I think it has become a bit of a buzzword. But it is something that people now are looking forward to having in their machines. So with the amount of memory the 1040 has, it will not be out of place to have a multitasking operating system that could run, coexist with TOS perhaps, by at least the third quarter of 1986.

BYTE: What about peripherals? Is Atari going to get in the business of printers and modems and the like?

Shivji: Yes, we have printers. We are working on a modem. We feel that a 1200-baud modem should be inexpensive. There have been a lot of advances in technology (such as the modem chips from Sierra Semiconductor). We hope that around the middle of 1986 we will have something to show.

BYTE: What about higher-end printers? With Atari leading this price/performance curve now, what about laser printers?

Shivji: We started talking to the people, around the time that the laser printers came out from Apple and Hewlett Packard. We have talked to a lot of the manufacturers. We're looking at something that costs about \$1200 retail, but we don't feel that it's really a mass item. Although imagine an ST in an engineering environment where you can get prints.

Yes, we were looking at it. As a matter of fact, the interesting thing is that the cost of building the ST board is so low that we were thinking of using the ST board as a driver for the printer. At 300 dots per inch, if you want to have a full page in the unit, you've got to have about one and a half meg of RAM. And we actually can support more than that. It's something that's in the pipeline. We unfortunately don't have control over the manufacturers. We actually looked at the LCS technology—the liquid-crystal shutter—which is similar to that. Casio uses that. It wasn't quite as good. Nowadays people are also pushing the LEDs [light-emitting diodes]. The company that is farthest along the line of good printers in LEDs is NEC. They have a really nice

ATARI 1040ST

one. We've been talking to them about getting their engine for quite a while. But right now it's too expensive. We could probably get it down to about \$1500 right now. We're looking more toward \$1200 and then under \$1000.

BYTE: *What about sound capabilities?*

Shivji: We had a project here started during Alan Kay's tenure—a chip called Amy. And the ST was designed to have the Amy. But the Amy did not happen. We had silicon, the first pass, in October or November, and we had severe problems with it. It was kind of an orphan project. There were a lot of people who had worked on it. And if you have a chip that has six or eight people who have worked on it at different times, chances of the chip working are slim. But it's a good design.

BYTE: *What does it do? What's so special about it?*

Shivji: The approach of others is that during horizontal-refresh time you go out to some place and put some memory out automatically, and that goes through a DAC [digital-to-analog converter] and you have sound. Essentially you're sampling at 15.75 kHz, which is the typical frequency. So it's like a digital tape recorder. You have a digitized sound and you're just putting it out. And it needs enormous amounts of memory. The key is: How do you encode sound? From an information-theoretic point of view, there are two problems with this approach. One is it's an enormous waste of memory. Because you could encode whatever sound you're going to play, as far as data is concerned in a sound piece, the data rate is extremely low. And doing it in the digital tape recorder way, you're wasting an awful lot of bandwidth and a lot of memory. The second problem with other implementations is that you only have 8 bits and it's not really that good. Especially with CDs coming out.

Amy was a chip that had 16 bits of information coming out. So you could have 96 decibels of range. What you could hear! Amy was a complete digital sound chip. It's called an additive-digital synthesizer. It had an adder and 64 independent oscillators. It has a model for sound and you feed it the

parameters. But if you do that you have to do an awful lot of preprocessing. We had hired a lot of people. We had a VAX 780 devoted to it. We had equipment, fast floating-point array processors, and so on, to analyze notes. We would get a tape of piano playing and then the VAX would analyze it and would take the Amy model and give the parameters. To play anything you only needed to have parameter tables and feed it to the chip.

BYTE: *Is it still a possibility then?*

Shivji: It is still a possibility. We were going to have the Amy, and then it didn't happen. Then we said, look, we want to have a base machine that's a good machine. Everybody doesn't really care about great sound, right? So let's not penalize people that don't care. Let's put something that will allow people who really care about sound to be able to play things. That's how the MIDI came in. And so if you get Amy, we could even have it out as a MIDI device. It's a great chip. Essentially all you do is you load it up. Off line you're doing an analysis of all the different things, and then you have it in table form. And you can play it any time you want. And you're not using up the bus that much.

BYTE: *If it has that kind of processing capability, it could probably build models for voice, too.*

Shivji: Exactly. We actually could reproduce opera sound. As a matter of fact, we had a sound lab. The type of sound that you could hear from that chip was just incredible. Again, 16-bit. Actually, the chip could even give you 17 bits if you wanted it to. The two problems are it needs too much memory and it hogs the bandwidth. The bandwidth you could probably get around. However, that's not the whole thing. You still have to move all that data around. Of course you don't get the data at the right place for free. For example, you have to move it somehow from a disk drive.

BYTE: *So the Yamaha chip is in there just to give it the basic sound?*

Shivji: Yes, just the basic sounds you need. Though, of course, the ports are very useful. ■



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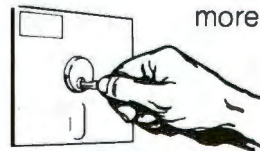
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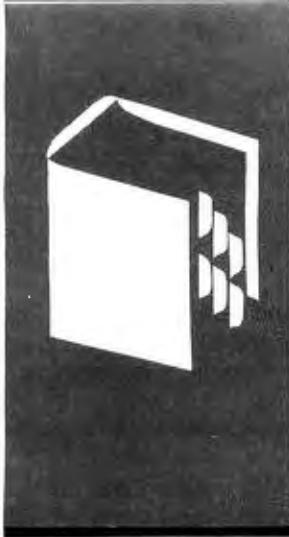
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68000 Wars: Round 1

Macintosh
Atari 520ST
Amiga

BY BRUCE WEBSTER

It is late November—almost Thanksgiving—as I finish writing this, and the editors back in Peterborough are screaming for my column. It's nice to be wanted, eh? However, if I don't wrap this up and upload it posthaste, I may be wanted in two or three states. Worse yet, a certain managing editor may end up being wanted for manslaughter, though I doubt if any reasonable jury would convict him. I must type faster. . .

I now have all three of the prominent 68000 machines: Apple's Macintosh, the Atari 520ST, and Commodore's Amiga 1000. I've had the Mac for nearly two years and the ST and Amiga for less than two months. And the single most common question I get these days is, "What do you think of the [one of the above] as compared to [one or two of the others above]?" Also, a lot of claims and counterclaims have been floating around concerning the relative merits of and problems with the three machines. In this column and the next few, I hope to sort out fact from fantasy and present some well-supported—if not completely objective—opinions. (Note: "Objective opinion" is an oxymoron, that is, a self-contradictory phrase, like "intelligent idiot" or "deliverable vaporware.")

MAC VERSUS ST VERSUS AMIGA

The format of this column is simple. I'll take a number of different areas, one by one, and give my opinion on how the three machines stack up—who wins, who places, who shows. Where possible, this is based on direct experience. However, since I am not all-seeing or all-knowing, I have asked questions of those with more experience or knowledge, and I've done my best to acknowledge them at the end of the column.

APPEARANCE AND PHYSICAL SETUP

The Macintosh wins this category easily. My 2-megabyte Mac has a 20-megabyte hard disk (MacBottom) and two disk drives (in-

ternal and external). The design is clean, attractive, professional, and unique. Better yet, the system takes up less than one square foot (9½ by 9½ inches) for the main unit and another 6 by 13 inches for the detachable keyboard, which can be easily moved 3 to 4 feet from the main unit. The Mac itself needs only one power outlet, though the hard disk requires its own as well. It definitely looks good in an executive suite and won't eat up all your desk space.

The Amiga comes in second, resembling the IBM PC (though, in my opinion, it looks nicer). The main unit is 17½ by 13 inches, covering more than twice as much desk space as the Mac. The monitor stacks nicely on top of the main unit, but a second (external) disk drive must sit to one side and takes up an 8- by 6-inch area. The detachable keyboard (6 by 16 inches) is larger than the Mac's, but it slides nicely under the main unit when not in use, and it can be moved almost as far as the Mac's. One warning, though: Since the expansion bus is on the right side of the Amiga, adding hardware is going to cause the Amiga to grow wider. The basic system (with two drives and monitor) needs two power outlets.

The ST comes in last, for reasons grouched about last month. The main unit is 18½ by 9½ inches. It therefore takes up less space than the Amiga, but neither the monitor nor the external disk drives can stack on it, so a complete system takes up much more desk space than either the Mac or the Amiga: A conservative estimate is about 21 by 21 inches. The keyboard is built into the main unit, so you don't have the additional space requirements for that, but you also don't have the flexibility of a detachable keyboard. The ST has a nice design but looks much like a home computer (which it is). Most unfortunate are the thick cables and external power supplies—one for the main unit and one for each disk drive. A basic system with monitor and two disk

(continued)

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drives uses four power outlets and seven cables. One last problem: With the main unit of the ST so wide, finding room for the mouse is tougher than with the other two systems.

MONITORS

For a monochrome display, the Mac barely noses out the ST, mostly due to cleaner-looking text and icons, as well as the monitor's size (i.e., built in, doesn't eat up desk space). However, if you are using the Atari monochrome monitor, you'll find it just about as crisp as the Mac, and the display itself is larger, both physically (12 inches versus 9 inches) and in terms of pixels displayed (640 by 400 versus 512 by 342). Both also have a true 1:1 aspect ratio. If you have an Atari color monitor, you can choose medium-resolution mode, which is 640 by 400 pixels with two colors; however, the aspect ratio is not quite 1:1, so icons and text look a little elongated. The Amiga doesn't have a monochrome mode or a monochrome monitor. You can set up a display using only two colors, but it doesn't look nearly as crisp as on the Macintosh or the 520ST.

For a color display, I think the Atari RGB (red-green-blue) monitor produces crisper, more brilliant colors than the Amiga RGB monitor (Model 1070). The Atari display has a cleaner look, while the Amiga display tends to look a little mushy. I'd like to swap monitors between the Atari and Amiga to determine where the real praise or blame for the display quality should go, but the Atari hardware uses a rare round 13-pin DIN connector that makes it hard to hook up other monitors to the ST or the Atari monitor to other computers. The Mac, of course, isn't even in the running for color display—yet.

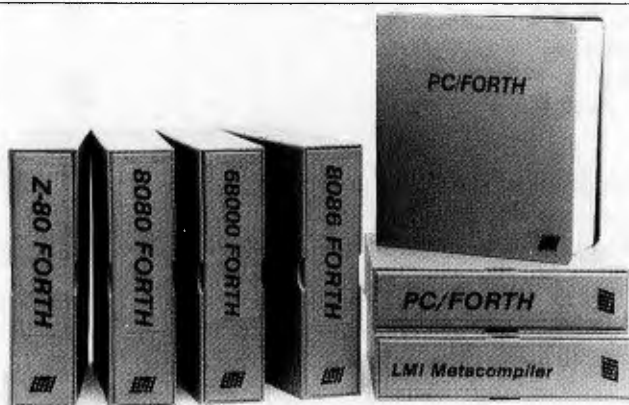
While the ST is the overall winner for display clarity, the Amiga completely blows the other two away for display versatility, i.e., video-signal options. The Mac has no external video output. The ST has both color (analog RGB) and monochrome coming out of a single port, but—as mentioned—it is hard to hook up anything but an Atari monitor. If you want both crisp monochrome and color graphics, you have to have both monitors, eating up more money and desk space. Also, a number of ST software packages will run only with the color monitor—I don't know of any that will run only with a monochrome monitor—so that complicates things even more.

The Amiga, however, presents you with multiple options. You have RF (radio frequency)-modulated video and audio, for hooking up the Amiga to older TV sets. You have high-quality NTSC (National Television System Committee) composite video for newer TV sets as well as color monitors you might have lying around from other computer systems. You have both analog and digital RGB output for RGB monitors and top-of-the-line TV sets. And Commodore has a genlock board that lets you take an external video source (laser disk, VCR, camera, TV) and mix it with your graphics display. The external video then

(continued)

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becomes the background "color" (color 0), with all other colors appearing on top of it.

GRAPHICS

While the ST and the Mac beat the Amiga in display quality, the Amiga breezes ahead of both in terms of graphics speed and variety. I'll have an extensive set of graphics benchmarks in next month's column, but here's the basic information about each machine.

The Mac has a single graphics resolution: 512 by 342 pixels, monochrome. Video RAM (random-access read/write memory) is a single 21K-byte block of memory; each bit represents exactly one pixel. There is no hardware support for the graphics, so every pixel that appears on the screen is put there by the 68000 processor. Extensive and sophisticated software support is provided via QuickDraw and other ROM (read-only memory) routines.

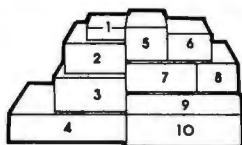
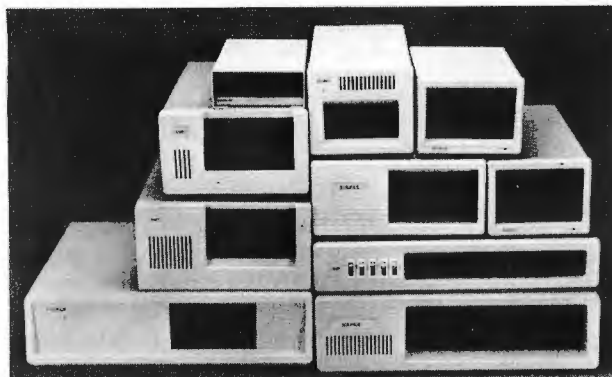
The ST has three graphics resolutions: 320 by 200 pixels, 16 colors; 640 by 200, 4 colors; and 640 by 400 (noninterlaced), monochrome. All colors are taken from a palette of 512 (3 bits each of red, green, and blue). A special mode lets you redefine the palette on each scan line; however, when invoked, you have to handle it for every scan line. Video RAM is a 32K-byte block of memory. An interlaced bit-plane approach is used. If you have four bit planes (16 colors), every four consecutive words represent one word from each of the four planes. Again, the 68000 processor has to draw each and every pixel on the screen. Software support is provided via GEM (from Digital Research), which has some limitations compared to the Mac routines. However, overall graphics performance on the ST seems to be better than on the Mac.

The Amiga has four basic resolutions: 320 by 200 pixels, 32 colors; 320 by 400 (interlaced), 32 colors; 640 by 200, 16 colors; and 640 by 400 (interlaced), 16 colors. You choose from a palette of 4096 colors (4 bits each, RGB). Bit planes are truly separate, can be located anywhere in the lower 512K bytes of RAM, can be larger or smaller than the display screen, and can be allocated as needed. For example, if you want a 320 by 200 display with 4 colors, you need to set aside only 16K bytes of RAM (8K bytes for each bit plane). Special graphics modes include half-bright (which lets you have up to 64 colors in the 320-resolution modes), dual playfield (which sets up two independent graphics displays, one "in front of" the other, with color 0 for the front display being "transparent" and letting the back display show through), and hold-and-modify (which lets you have up to 4096 colors on the screen simultaneously). You can change resolution (320 versus 640) and palettes at will while moving down the screen, and you can scroll both vertically and horizontally merely by changing some register values.

Most of the grunt work is done by custom graphics hardware, leaving the processor free to do other work (more on this in a minute). And I haven't mentioned hardware and virtual sprites, object animation, hardware collision

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detection, multiple screens and windows, display list processing by the Copper (graphics coprocessor), minterm processing by the Blitter, and so on. Software support exists on three levels: direct access of the custom chips, low-level graphics routines, and high-level graphics routines. The routines are not as complete or polished as the Mac's but still have some significant capabilities not found in the other two machines.

A DIGRESSION

I want to make some comments here about the custom chips on the Amiga, mostly in response to some misleading and distorted comments floating around on the bit stream. The internal bus of the Amiga runs at 14.2 megahertz, twice the clock rate of the 68000 processor. Alternate cycles are given to the 68000 and the DMA (direct memory access) channels, so that the 68000 is usually running at full speed. However, two different situations can occur to cause the 68000 to run slower.

First, if the 68000 is running code located in the lowest 512K bytes of RAM (the Amiga's internal memory, known as chip RAM), contention may—but does not necessarily—occur between the 68000 and the DMA channels. You can, for example, run a four-plane low-resolution (320 by 200 by 16) display (or a two-plane high-resolution display), with all four audio channels, all eight sprites, and be accessing the disk as well—and the 68000 will still be going full tilt. However, if you have a six-plane low-resolution display, the 68000 will slow down by 50 percent during the video update cycles, due to bus contention, if and only if the 68000 is accessing chip RAM. (Note, though, that the 68000 still has no contention during horizontal and vertical blanking.) However, if you've expanded the Amiga beyond 512K bytes, and your code is running in the external memory (known as fast RAM), there is no contention at all, and the 68000 continues to run at full tilt, regardless of the current screen resolution.

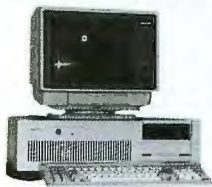
The second situation in which the Amiga's 68000 loses cycles is when the Copper or the Blitter is running. Both will steal cycles to accomplish their work; however, since both can accomplish in a few cycles what would take the 68000 many cycles, the net effect is significantly greater performance than either the Mac or the ST, both of which rely upon their 68000s to draw every pixel.

SOUND

The Amiga is the winner in the area of sound. It has four audio channels, each with its own 8-bit D/A (digital-to-analog) converter and DMA channel. Left and right audio outputs on the back (standard RCA jacks) let you hook up the Amiga to your RGB monitor (you'll need a Y-adaptor) or your stereo system; two channels are assigned to each output. (By the way, both outputs also go out through the TV video port, though the current RF modulator combines them to produce monaural sound.) Because the audio channels are DMA-driven, they can run

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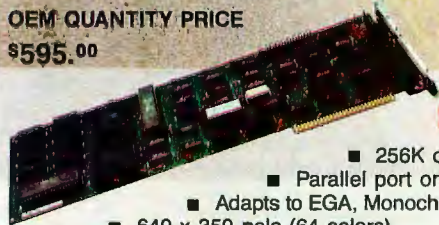
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with little processor overhead. You can also combine channels to do frequency and amplitude modulation. The Amiga's software support of sound is also excellent, including standard routines to play back digitized sound and to do speech synthesis.

The ST takes a different approach to sound. It has no D/A converters or audio outputs. Instead, it uses a standard three-voice sound chip, which was designed primarily for music synthesis and arcade sound effects and has previously shown up in machines like Mattel's Intellivision. Again, use of this chip helps to relieve any burden on the processor; however, you do not have the same ability to play back digitized sound found in the Amiga (or, with some work, in the Mac). This audio signal is then fed to the monitor via the cable. However, what excites a lot of music enthusiasts about the ST are the standard MIDI (musical instrument digital interface) in and MIDI out ports on the back. This makes it easy to use the ST to control synthesizers and other audio exotica, with some impressive results. Software support for both the sound chip and the MIDI ports seems to be minimal, though; all I could find in the technical documentation were a couple of BIOS (basic input/output system) calls, and I found no information at all as to how the hardware worked.

The Macintosh has a four-voice synthesizer using a single 8-bit D/A converter. Only a little overhead is involved with a single voice, but if you're running all four voices, you place a significant load on the 68000. It is possible to play back digitized sound, but it requires custom software; the ROM routines do not directly handle it.

SYSTEM SOFTWARE

The Mac wins here. For all the grousing that I and others have done about the Mac's Finder, OS (operating system), and even its Toolbox, they are still perhaps the finest system software put on a microcomputer, and they really shine when viewed next to the ST and the Amiga. Of course, Apple has had longer to polish them, but I think the Mac at its release still had far better stuff than either of the others, especially since it had to run on a 128K-byte machine.

It is hard to come up with a clear winner between the ST and the Amiga in the area of system software, but I'll go with the ST, mostly because of GEM and GEM Desktop. Even though they have some limitations and often lack intelligence and flexibility, they are still more polished than their counterparts on the Amiga. And because of the accepted limitations, GEM can often outperform both the Mac and the Amiga in standard system functions (opening windows, etc.). Atari was smart to go with a system to which someone else had already devoted a lot of resources, leaving Atari with more time to concentrate on the hardware.

Commodore, on the other hand, has done everything in-house and just hasn't done the job on the Amiga system software that it should—probably due to too few peo-

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ple and too little money. The Amiga is a complex piece of hardware; writing ROM and OS routines to take advantage of that complexity isn't easy, and the gaps often show. I do not like AmigaDOS, which is a modified version of Tripos, a 68000-based OS developed in England (see the February BYTE U.K., page 321). It is nonstandard, ignoring common microcomputer conventions like Control-Q/Control-S, wild cards, and so on. The command-line interpreter is simply a little routine to execute programs, so that even common commands like DIR (show directory) and CD (change directory) require it to go back to the boot disk to load in a DIR or CD program. Intuition, a window-based user interface, works nicely but will not show you any file on a disk that does not have an icon explicitly defined for it; in other words, each file must have a corresponding <filename>.INFO with the icon definition inside for you to be able to open, move, delete, or execute the file; otherwise, you have to use the command-line interpreter.

If there is a bright point to the Amiga's system software, it is the multitasking Kernel, which makes everything you do inherently multitasking; you can, for example, edit a file while compiling another one. Since the Kernel exists below AmigaDOS and Intuition, no special provisions need to be made for handling the multitasking. Mac and ST developers make a lot of noise about multitasking on their systems, but in both cases it will have to be something of a retrofit and a kludge.

APPLICATION SOFTWARE

The Mac has the advantage, simply because it has been out so much longer than the other two machines. There is a wide variety of polished, professional applications for just about every use (though, curiously, the selection of word processors is limited). The Mac market continues to mature and grow, and some second- and third-generation packages are beginning to emerge, held back mostly by the previous limits on memory and mass storage.

The ST has an impressive number of titles available right now, as demonstrated by the large and crowded Atari booth at COMDEX, probably more so than the Mac had four months after its release. Most though, are geared toward development, entertainment, and personal productivity; few slick, powerful programs have come forth, simply because they take longer to write and because the ST's memory is being eaten up by TOS/GEM, which is not yet in ROM. Also, I suspect that most business software houses don't see the ST as a business machine, so they haven't put any effort into developing programs for it.

Few titles are currently (November) shipping for the Amiga. This is so for a couple of reasons. First, the Kernel and system software have been changing continually all year, and many developers have had to do significant rewrites to accommodate each change. Version 1.1 of the system software is due to be released within a few days, and a number of firms plan to start shipping titles as soon

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as that happens. The second reason is that most developers (such as those who attended the Amiga developers' seminar last May) weren't able to get machines until late August or early September, while the ST has been in the hands of developers since last spring. One possible saving grace: Some of the big guys, including Microsoft, are doing serious development work on the Amiga and may help it to get some professional software.

PORTS

This is a close one. All three machines have good and bad aspects, but I'll pick the ST as the winner on the basis of three ports: the hard-disk DMA, the serial port, and the printer port. As I mentioned last month, I was impressed when I could simply unplug my printer and modem cables from my Compaq, plug them into the ST, and immediately use my Epson printer and Hayes modem. No fuss, no muss. And the hard-disk port helps to offset the lack of an expansion bus. The two MIDI ports and the two joystick ports are also assets, while the very obscure 13-pin video port and the lack of composite or RF video output are liabilities.

The Amiga gets good marks for the variety of ports: parallel, serial, floppy disk, RGB, composite video, RF video, left and right audio, and dual ports that can accept mice, potentiometer- or switch-type joysticks, or light pens. The bad marks come from some of the nonstandard pin-outs. The parallel port uses a DB-25 (male) connector rather than the DB-25 (female) connector of the IBM PC. So (unlike the ST) you cannot just plug in an IBM printer cable; instead, you have to use a special Amiga cable. Likewise, the serial port is not standard RS-232C but has some unusual signals for a serial port, like audio in, audio out, and several voltage levels (-5, +5, and +12). The RGB port uses a DB-23 connector that, while easier to build than the Atari's 13-pin DIN, is still odd enough to slow you down.

The Mac gets negative points for the lack of ports—just two serial ports—and their nonstandard nature, i.e., "almost" RS-422. This is especially serious in light of the lack of any external bus or internal slots. Which brings us to the next topic. . .

EXPANDABILITY

The Amiga comes in first, simply because it's the only one of the three really built to be expandable. Both the Mac and the ST are closed boxes, though heroic efforts are being made for after-the-fact expandability. Having been through the Amiga technical documents completely, I can tell you that the machine was designed from the ground up, both in terms of hardware and software, to grow. The 60-pin expansion bus gives external hardware complete access to and control of the insides of the machine, including the custom chips. The memory map allocates a little over half to RAM (8½ megabytes); much of the rest is reserved for future use. Part of the memory map is set

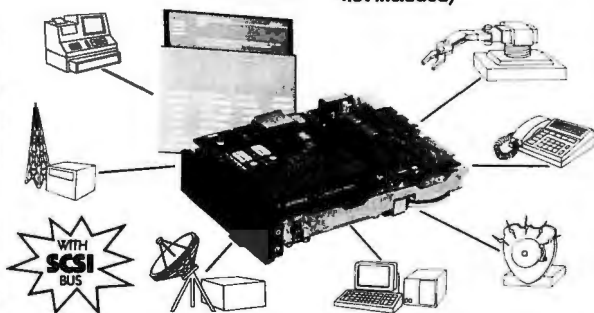
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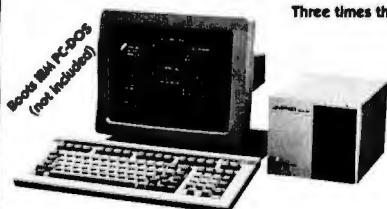


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aside for expansion hardware, so that if developers follow the protocol given, the system will configure itself when booted, avoiding the need for DIP (dual in-line package) switches and so on.

One of the best examples of the Amiga's open architecture comes from Computer System Associates, a firm that makes a board for 68000 development systems. The board, which plugs into the 68000's socket, has a 68020 processor and a 68881 floating-point processor. Vic Wintriss, the president of CSA, bought an Amiga, opened the machine, removed the 68000, and plugged in his board. Not only did the Amiga work fine, but Vic says he got an immediate 70 percent increase in speed, which doesn't count the floating-point hardware. Similar attempts to upgrade the Mac have failed; I don't know if anyone has tried it with an ST.

As mentioned, neither the Mac nor the ST is designed to be expandable: the Mac, because of philosophy; the ST, because of cost. It is possible to expand RAM in both, but this is usually at the cost of your warranty and sometimes your power supply. ROM changes and system-software patches are often required as well, and some application programs may not work or may not recognize the extra memory. And neither is really set up for significant non-RAM hardware expansion. The ST does have an edge over the Mac, though, because of both the hard-disk port (which uses DMA for speed) and the cartridge port (which makes some data and address lines available). Also, because the 520ST is not designed for hardware expansion, most of its 16-megabyte address space is available for RAM, while the current Mac is pretty much limited to 4 megabytes.

TECHNICAL MANUALS

The Amiga wins here easily. The seven technical manuals—more than 2000 pages, all professionally printed and bound—are the best I've seen for a new computer and may well be the best I've ever seen for any computer. They are well written, well organized, and amazingly complete, covering hardware, Kernel routines, AmigaDOS, and Intuition. Addison-Wesley is bringing out mass-market versions of the manuals; the ones I have were put together by Commodore, which makes the feat even more impressive.

Inside Macintosh is, well, the manual we all know and love. And hate. It is a large collection of technical notes about various aspects of the Mac's system software, with almost no mention of, nor significant information about, the hardware. There is little overall organization to the manual; however, most sections follow a consistent format that makes it easy (once you've found the right section) to dig out what you need. However, as Kathe Spracklen (coauthor of *Sargon II*) once observed, each section (there are 30 or so) requires that you understand all the others, which can make your initial exposure to *Inside Macintosh* a challenging experience in intellectual bootstrapping. I have

(continued)

both the original loose-leaf and the phone book editions. Addison-Wesley is bringing out mass-market versions of *Inside Macintosh* in softbound and hardcover editions.

Then we have the Atari technical documents, such as they are. These can be divided into two major groups: those from Digital Research and those from Atari. The documents from Digital Research, which make up the bulk of the package, are generally well done, if sometimes sparse on explanations and examples. However, the Digital Research documents all refer to other machines or systems. The GEM documents—which are exactly the same as those I received at the seminar last spring—all refer to the IBM PC, while the language documents all refer to CP/M-68K. There is, in fact, a CP/M-68K manual in the package, though the ST doesn't use it. The Atari manuals leave much to be desired. They are generally photocopies of dot-matrix output and are sparse and incomplete. The ST hardware documents, including schematics, are about 15–20 pages; by comparison, the Amiga hardware manual is more than 300 pages (and, of course, the Mac hardware manual doesn't exist). The DOS, BIOS, and "Line A" documents for the ST are better than its hardware documents but still represent less than 300 pages (more than 400, if you include the BIOS listing), while the Amiga ROM

Kernel manual alone is 1500 pages long. More isn't necessarily better, but in this case it definitely is.

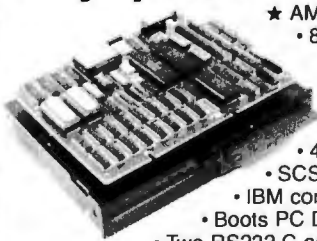
PRICE AND PRICE/PERFORMANCE

The ST wins the price comparison by a wide margin—there is just nothing like it for less than \$1000. It was not long ago that a Commodore 64 with a disk drive and color monitor cost \$995. Now you can buy a 520ST with an RGB monitor and a single-sided disk drive for the same price. The ST also wins the price/performance comparison, but not by as much. The 520ST is a closed box with a fixed shelf life; Atari has announced its successor, the 1040ST, but there will be no upgrade path to it, at least no easy one. Even so, Atari will probably continue to sell as many 520STs as it can make.

Despite its impressive credentials, the Amiga is still somewhat overpriced, though not (in my opinion) as badly as most people claim. I can buy a \$1295 Amiga—which has 256K bytes of memory and a double-sided disk drive holding 876K bytes—take it home, hook it up to my TV set or a spare color monitor (using RF, composite, or RGB), boot up BASIC, and have more than 40K bytes of memory available. To do the same with a 520ST, I would have to

(continued)

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Each machine has its

strengths and its weaknesses.

spend \$1095, which would get me the nice Atari RGB monitor (since the ST can't use a TV set or a composite color monitor), a double-sided drive (holding only 709K bytes, or about 81 percent of the Amiga's drive), and 512K bytes, of which only about 256K bytes is available since GEM/TOS is not in ROM yet. (However, I have just had late word that Atari has started shipping EPROMs with GEM/TOS to developers and that ROMs for end users should be available shortly. That will make a big difference in the amount of memory available for applications.) And while I would like to see the Amiga down at, say, \$995, Commodore has little incentive right now to lower the price since—like Atari—it's selling all it can make.

I'm not sure what the Mac's official list price is, but the street price right now for a 512K-byte single-drive (400K bytes) Mac is slightly less than \$2000. The Mac, therefore, comes in a distant third in both price and price/performance. Since the Mac still has a tremendous advantage in terms of software, support, and company stability, the price isn't likely to come down too far or too fast.

WRAP-UP OF ROUND 1

Based on the observations above, there is no clear winner. Each machine has its strengths and its weaknesses. The Mac is an established machine, with lots of software and hardware available, a large installed base, and sound financial backing (at least in comparison to Atari and Commodore). The 520ST is an amazing bargain, much more a computer "for the rest of us" than the Mac ever was, and it should sell well. The Amiga is slow coming out and is in a precarious position in terms of price, software, and financial backing. But if it (and Commodore) can survive the next six months, the Amiga could easily be around for 5 to 10 years, long after 520STs are gathering dust on closet shelves.

IN THE QUEUE

Next month will feature round 2 of the 68000 wars. I'll have a number of tables comparing system features and showing the results of various benchmarks. I hope to squeeze in comments on some of the software that is piling up, especially those packages for the 520ST and the Amiga. Until then, I'll see you on the bit stream. ■

Many thanks to the following people for technical information and corrections: Eric Zocher of Silicon Beach Software; Bob Pariseau of Commodore; Neil Harris of Atari; Jez San of Argonaut Software Ltd.; Scott Turner of L5 Computing; Charlie Heath of MicroSmiths; the Amiga crowd on BIX; and the SIG ATARI crowd on CompuServe.

(continued from page 32)

ANOTHER SOFTWARE-ONLY SPEECH SYNTHESIZER

I am writing about a letter from Gary W. Odom of Melbourne, Florida, entitled "Long Live the Macintosh" (Letters, October 1985, page 30). In his letter he said, "The four-voice sound generator produces astounding computer music, so good that

the Macintosh has the only software-only speech synthesizer available on a computer of any size."

I would like to correct his error. I have an Atari 400 and 800XL, and both have four-voice music with the ability to synthesize speech using S.A.M. by Don't Ask Software. S.A.M. produces speech and allows the user to vary both pitch and speed.

I may be overreacting, but it bothers me when someone makes an all-encompassing statement, as in Mr. Odom's letter. Some degree of responsibility must be assumed by anyone making such a statement. Without this responsibility, a letter becomes pure conjecture and opinion.

ROGER N. ASCH
Fishkill, NY

VLSI: NOT VERY

So many of your articles use the acronym VLSI (very-large-scale integration) when indeed LSI would be the correct term. For instance, in the January issue, "The Acorn RISC Machine" by Dick Pountain (page 387) stated that the ARM chip contains 25,000 transistors. Surprise! This meager amount of devices constitutes LSI, not VLSI, and there is a vast difference in complexity.

Here is a table for your reference showing the relationship between level of integration and device count.

Device Count	Integration
1,000,000	VLSI
100,000	VLSI
10,000	LSI
1,000	MSI
100	SSI

Examples of LSI are the 68000 microprocessor and 16K dynamic RAMs. Examples of VLSI are the 80286 microprocessor and 64K dynamic RAMs. Please try to apply some standard meaning for integration acronyms.

DANIEL J. PAYNE
Santa Cruz, CA

WHO NEEDS INTEGRATED PROGRAMS?

Jerry Pournelle's comments in the 10th anniversary issue (Computing at Chaos Manor, September 1985, page 347) just confirmed my feeling that integration is becoming a much less important term in computerdom. In fact, I think the integrated products have reached their zenith and it will all be downhill. AppleWorks notwithstanding.

As a journalist and a computer user since 1980, I've been using Apple PIE for word processing and pfs:File and dBASE II for database applications. Until recently, I had no use for a spreadsheet. When I did start using a sheet, I went to my own library, shook the dust off an early version of VisiCalc, and starting using it.

The reason I haven't changed my main programs is comfort. I know all four programs backward and forward, well enough

(continued)

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AMIGA IBM PC EMULATOR

amiga/main #778, from atm [Andrew McLaughlin]

Does the IBM PC emulator allow the Amiga to operate "normally"? By that I mean, can you boot the emulator, start something running under the emulator, and then also run Amiga programs (e.g., Boing!)?

Also, what is Commodore planning to do when they finalize the ROMs? Will we have to ship them to West Chester for service or ?

amiga/main #787, from cheath:
a comment to 778

The emulator is "stand alone"; it takes over the whole machine.

Regarding ROMs, it has been a unanimous plea among developers to *never* put the ROM software in ROM. This is to allow alternative operating systems like UNIX to run without using any extra RAM. If the Writable Control Store is always there, alternative operating systems can count on it. The short-term policy of Commodore seems to be to keep the WCS. I don't know if they have a long-term policy.

MORE ABOUT BOING!

[Editor's note: For more on this topic, see *Best of Bix—Atari*]

amiga/main #736, from greggw

Regarding the bouncing-ball demo, is it true that the Amiga bouncing-ball demo *could* have been faster but was slowed down to make it look realistic? (Just idle curiosity.)

amiga/main #747, from greggw:
a comment to 736

Folks, Bob Pariseau sent me a letter that includes the following remarks about the Boing! the bouncing-ball demo; I thought I'd share them. (Letter excerpt follows.)

The ball can be made blindingly fast without any significant increase in 68000 overhead. The ball rotation is done by color cycle animation. Each red and white patch on the ball is actually 7 strips of color.

Push the Workbench screen to the back while the ball is forming (LeftAmiga-M), and you'll see what I mean. We assign 14 of the 32 color registers to ball rotation. At any instant 7 are white and 7 are red. We cycle the colors through them to make the ball appear to rotate. To rotate faster, just cycle faster. How fast can you change 14 memory locations with a 68000?

The ball bouncing is done by changing the start-of-data pointers for the ball/shadow bit planes with respect to the grid bit plane. By clever use of the video DMA pointers, the grid appears stationary while the ball appears to move. Again, no blitting is involved. Again, making it go faster is easy.

Curiously enough, the hard thing is making the ball go *slowly* and still appear to be smooth. We can get as slow as you see on the Amiga because, with 32 color registers, we can afford to burn 14 just on ball rotation.

ATARI

[Editor's note: Before using February's instructions to upgrade your 520ST, read *Atari/tech.st* #239 or download *ST.DOC* from *BYTenet Listings*.]

This month, Dave Betz describes his experiences in porting XLISP successfully to the Atari 520ST, David Allen presents some background information on the new *Grolier/Activature* CD-ROM encyclopedia, and there are comments on BASIC, DEGAS, and the Atari Boink demo.

XLISP

atari/tech.st #122, from dbetz [David Betz, Contributing Editor, BYTE]

I just got my Atari ST development system and software. I'm intending to port my XLISP interpreter to the ST. My first goal is just to get the generic version running on the Atari. Then, I'm going to add some support for interfacing with the GEM graphics routines. My first problem is that, looking through the C compiler disk that came with the development package, I seem to be missing the `setjmp.h` include file that supports the `setjmp/longjmp` library routines. These routines are mentioned in the CP/M-68K C manual that came with the development package, but I have been unable to find the supporting include file. Anyone have any idea where I can get a copy of it (it should be only a single line long)?

atari/tech.st #125, from dbetz

Well, I've just gotten all of the XLISP source code to compile and link on my ST (but not run, unfortunately). I thought that I'd share something of my experiences in accomplishing this.

First, I'm sure that I had the same reaction as everyone else the first time I realized the number of cables required to hook up this beast. I have two drives and both monitors, so I guess I have the maximum number of cables possible. Before I could do anything with the machine I had to buy one of those multi-way power adapters just to free up enough outlets to plug in the four power cables! It really is pretty easy to set up, though. I didn't read any of the manuals and managed to get it to work the first time. Once I had all of the cables and power supplies (three) hidden behind the machine and under the table, it really looked nice sitting on my computer table (next to an old DEC Rainbow with only 256K of memory).

The first thing I needed to do was to copy all of the XLISP source code from my Rainbow to the ST. I used a program called LCTERM on the Rainbow and Kermit on the ST. The transfers happened flawlessly! I typed a single command on each machine and transferred all 24 XLISP source files to the ST without any errors at 9600 baud. This took a while, but since everything happened automatically, I didn't have to stay and babysit. I went off to the living room and read about GEM.

After transferring the files, I had to do some minor editing in order to select the correct options for compiling with the DRI C compiler. I used MicroEmacs and had no trouble changing the few lines required to tailor XLISP.H for the ST.

Then I started to compile the sources. My first problem was to track down three include files that should have been part of the C development package but were left out of the version that I received. The files in question were `setjmp.h`, `ctype.h`, and `math.h`. I searched through all of the disks that came with the development package and couldn't find any of them. The C documentation mentioned the existence of both `setjmp.h` and `ctype.h` but didn't even mention `math.h`. Well, in order to proceed, I made an educated guess about what went into those files and created my own versions. After this, all 23 XLISP source modules compiled without errors!

Then it was necessary to link all of the resulting object modules. I used MicroEmacs to create a batch file to run the LINK68 and RELMOD programs to create an executable version of XLISP. Because there are so many object files in XLISP, I had to create a separate input file for the linker. This was easy to create using MicroEmacs also. I had no trouble linking XLISP and creating an executable file with RELMOD. My only problem now will be to find out why XLISP doesn't work! When I run XLISP, I get the banner line and then the program immediately exits. Just before exiting, I get two tiny mushroom-shaped characters at the left-hand side of the screen centered vertically. I have

(continued)

no idea what these mean or why the program just exits without doing anything, but in the next few days I hope to find out.

All in all, I am impressed with the ST. It hasn't crashed as much as I had been led to believe that it would. It has a very nice crisp monochrome display (I haven't really tried the color monitor much yet). The keyboard seems reasonably good. The desktop software seems to work well, although I did experience some strange behavior after compiling about 15 of the 23 XLISP source files. When one of the compiles finished and I returned to the desktop, one of the disk windows had mysteriously been closed. When I tried to reopen it, I was unable to. I had to reset the machine to continue with the next compile.

The COMMAND.PRGM doesn't seem to be very useful on its own. It doesn't have any way to copy files from one disk to another. It doesn't have a way to rename files, and its delete program (RM.PRGM) doesn't accept wild-card file specifications. When I invoked MicroEmacs from the command-line interface, I ended up in the editor with no visible cursor! I was able to edit, but I had to insert dummy characters to determine where the cursor was. Fortunately, it isn't really necessary to use the command-line interface. Everything that you need to do can be done through the GEM desktop.

In summary, I really am impressed with this machine. I like the crispness of the display in monochrome and the window system seems to be fairly responsive. I wish the packaging was a little nicer (fewer cables, maybe one built-in disk drive, no external power supplies). It could use higher capacity disks. (I am aware that a double-sided disk is now available. It should probably be made standard.) What I *really* like about it is that I get a fast, 68000-based machine with a high-resolution bit-mapped display for under \$1000! I think that this machine has quite a bit of potential, and I intend to continue to explore its capabilities. I want to develop a good interface to the graphics support from within XLISP, and I'm sure that I'll have some comments about programming with GEM in the process.

atari/tech.st #126, from jsan [Jez San, Argonaut Software]:
a comment to 125

If you are not already linking the file apstart.O to the front of your object files, then please do so! It sets up and reserves a Stack area for your application program to use and thus is vital to the correct execution of your program. Simply ensure when linking your file together that apstart.O is the first one in the list.

Failing that, two mushrooms means an address error (I think, or is it bus error?).

Let me know how you get on.

atari/tech.st #128, from dbetz:
a comment to 126

I am linking with gemstart, gemlib, and libf. I just noticed that the default stack size is only 1000 bytes, so I'm going to try increasing that to about 16K and see what happens. Thanks for the advice.

atari/tech.st #129, from jsan:
a comment to 128

I'm not familiar with gemstart, so I wouldn't know if it performs the functions of apstart too, but just in case, please try linking in apstart *before* gemstart and see what happens?

atari/tech.st #130, from dbetz:
a comment to 128

Well, I increased the stack size to 16K by reassembling gemstart.s and XLISP came up and printed its prompt. I tried typing an expression

(just a number) to see if it really worked and got no response. XLISP thinks that all lines need to be terminated by a linefeed, and I suspected that the run-time library might be looking for a CR-LF pair at the end of a line, so I typed Ctrl-J (the code for LF) and XLISP printed the result of evaluating the expression! I would have been impressed except that immediately after printing the result, XLISP exited back to the desktop. The only reason that XLISP would do this is if the next call to getc returned end-of-file. In order to test the behavior of terminal input in a simpler environment, I wrote a very simple test program. Here is the text of the program:

```
#include <stdio.h>
main()
{
    int ch;
    for (;;) {
        ch = getc(stdin);
        printf("%02x ",ch);
        if (ch == '\n')
            printf("\n");
    }
}
```

This program just reads characters from stdin and echoes the ASCII code of the character in hexadecimal. It starts a new line every time it gets the LF character. I ran this program, and absolutely nothing happened when I typed characters. I did some further investigation and found out that getc(stdin) was *always* returning -1 (end-of-file). I have no idea what I am doing wrong and am not sure how to proceed from here. It seems as though the standard I/O library just doesn't work correctly when reading from the keyboard.

In addition to this problem, I have been continually plagued by disk windows getting closed automatically on return from an application. Whenever this happens, I am unable to reopen them. I must reset the machine and start the desktop over again.

While I still like the hardware on this machine, the software seems to leave a lot to be desired. Why doesn't it come with its own development documentation? The C manual and the system documentation are for CP/M-68K; the GEM documentation is for PC-DOS. After taking a few minutes to look at the documentation for the Amiga, I am left with the feeling that this machine was released too soon. It doesn't really have adequate development tools. I suppose that someone will point out that the Macintosh didn't have any decent development tools when it was released either. The difference is that the ST doesn't come with any useful applications (like MacWrite and MacPaint) or any decent tools to build your own applications. In its current state, it's a not a very useful machine for either a software developer or an end user. I'm going to continue to struggle with it for a while. Maybe the support for developing native applications is better than the support for porting generic programs like XLISP.

atari/tech.st #131, from jsan:
a comment to 130

On CompuServe, Russ Wetmore (sysop of Atari SIG) has uploaded the C stdio header file. I suspect it will work better than the ones you are presently using.

I'm afraid I have no experience of C. I only use the ST from an assembly-language viewpoint and can easily help you with I/O that bypasses TOS, but I can do nothing much to help you with OS calls of any description.

(continued)

atari/tech.st #140, from dbetz

Well, I finally finished my port of XLISP to the 520ST. It seems to work pretty well. It is a bit faster than XLISP on the Macintosh, but you have less space to work with on an ST than on a 512K Macintosh. I assume this will be fixed once the OS comes out in ROM. The only major problems that I encountered were some missing include files (ctype.h, setjmp.h, and math.h). I invented my own versions of those files and was able to compile all of the XLISP code without further problems. My next problem was that the standard I/O library that comes with the DRI C compiler doesn't seem to work when doing I/O to the terminal (keyboard/screen). I ended up writing my own code for terminal I/O. Once those two problems were solved, XLISP came up and ran without a hitch. I uploaded it to the Atari area of the Listings conference. The file is called XLISP.TTP and should be downloaded in binary mode. The documentation for the ST version is the same as the IBM version and the Macintosh version. You should be able to find the documentation text file in the Macintosh area of Listings under the name XLISP.MEM. If you download XLISP, please let me know what you think and report any problems you might encounter.

CD-ROM

atari/tech.st #11, from dpallen [David Allen]

Grolier engaged with Activenture to produce this CD-ROM as the first practical exercise of a new CD-ROM authoring language by Activenture (a company formed by Gary Kildall of Digital Research fame) called KRS, or Knowledge Retrieval System. This is a high-level "language" that is designed to work on a DEC VAX-11/750. When fed with any large database from a master machine-readable source, KRS creates a "file inversion" or electronic index of the database. This can be as large as the database itself, and in the case of the Grolier encyclopedia, does, in fact, occupy 60 megabytes of CD-ROM real estate, the same amount that the encyclopedia itself occupies. KRS is written in C.

In comparison, the encyclopedia itself also occupies 60 megabytes of CD-ROM space and is the equivalent of 10 volumes of 10,000 pages of nine million words. So there is room for *three* more totally different "encyclopedias" of the same size! (Don't look—they aren't there!)

The file inversion is a specially constructed file of *all* of the keywords in the database less some "stop words." Stop words are those words that appear in the database more than 32,767 times and are considered unworthy of search. These include words such as "the," "an," "and," "of," and about 25 other words in the case of the encyclopedia.

The user may institute a search for any combination of keywords and the KRS will come back with suggestions. For example, if a student was writing a report about the relationship between Eisenhower and Nixon, he might ask for all the entries with those two names. The system would respond by asking if the user wished those entries with the keywords in the same paragraph or same article. Within 3–5 seconds the system will deliver a list of all entries so described. The user may apply any sort of Boolean logic to enter the keywords (all that have word A but not word B, or all that have word A and word B or word C, etc.).

Activenture is promoting itself as "optical typesetters" and is prepared to massage any third-party database with KRS for similar results.

The encyclopedia disk will be marketed by Grolier, and there will be a parallel marketing campaign for the necessary hardware to play the disk on. The hardware will not be OEM'd by Grolier but will be marketed by the manufacturer of the hardware. No official announcement yet of the brand(s) of CD-ROM hardware to be available at that time nor of the computers to be initially interfaced, but my intuition says to expect that the initial computers to be interfaced will be the IBM PC (and clones) and the Atari ST.

atari/tech.st #39, from dmenconi [Dave Menconi]

I can't help but think that the encyclopedia is going to be important. I have always thought that the *real* use for computers would be to supply users with a library of information in an easily indexed way. That way the user could find facts quickly. This will eliminate a lot of the half-truth myths and "pseudo-science" that plagues us now. Is anyone writing a more sophisticated access system for all that data than just a word search? Like something that would answer the question: "What is the relationship among average rainfall, the value of the dollar, and the age of the president?" I admit that this data is not going to be on the first disk, but there will be other disks and a word search just doesn't do it. Anybody have any ideas about the best way to access all that data?

atari/tech.st #40, from dpallen:

a comment to 39

I played around with the Grolier on an IBM PC last week. KRS really works very well, although I think they are a bit optimistic on their maximum search time of 5 seconds. More like 10.

I exercised using some Boolean functions and it handled them very nicely. (Find A and B and C; find A and B and not C; etc.) Came up with just what I was looking for.

Phillips was showing off a new CD-ROM database manipulation consisting of a newspaper file with pictures in both black-and-white and color. Used an AT&T video digitizer board that worked really well. (Expensive.) It also provided sound over still voice with each picture.

atari/tech.st #41, from neilharris [Neil Harris, Atari Corp.]:

a comment to 40

I think the way to go is to develop a parsing language similar to the one that Infocom uses in their adventure games. Searching the database itself is easy using Activenture's inversion process, but some intelligent preprocessing would add a dimension that would make life easy.

FIRST WORD ON BASIC

atari/news.st #136, from jimj [James Joyce]

I sent in my registration card and Atari sent me ST BASIC this week. The package included disk and manual. The manual is much better than the Logo manual I received when I bought my system. There are some typos and errors. One major omission is a chart for the SHAPE argument of WAVE. (And I sure would like to know how to use WAVE.)

The sample programs they give in the back are nice. The one titled "Low Resolution Demo" seems to be excessively slow, but I haven't checked to see if I inserted my own typos here, so it may be my fault.

BOINK AND THE AMIGA

atari/non.tech.st #102, from jsan

In our latest game (on the Atari ST) we've got sampled sounds and speech working! Yes, it *can* be done. It's just nowhere near as good as the Amiga's hardware, since ours is done in software and requires about 6 percent overhead in processor time to accomplish an 8-kHz bandwidth. It's not bad, nevertheless.

I would say that Atari's Boink program is a stunning effort of high ingenuity in trying to beat the Amiga. I'm very impressed that they got it *that good*!

atari/non.tech.st #105, from cheath [Charlie Heath, MicroSmiths]:

a comment to 102

> Six percent of cycles; what percent of development effort?

(continued)

atari/non.tech.st #106, from jsan:
a comment to 105

Hmm, what do you mean what percent of development effort?

If you mean how hard was it to write, then, well, it was an offshoot from the normal Sound (d)effects subroutines that we had to write *anyway*, and so we decided to go one stage further and add full sampled synthesis (which allows Speech, or any other digitized waveform). It's less than a week's work for a full-time machine code programmer, but most ST programmers don't do machine code. (C seems to be overpopular!) Here in England, people are raving about Modula-2, but as far as I'm concerned nothing beats machine code for either execution or readability!

atari/non.tech.st #112, from neilharris:
a comment to 95

After seeing the two bouncing balls (ST and Amiga) side by side for 5 days at COMDEX, not one person thought Amiga's was any better, faster, or smoother! Any arguments?

atari/non.tech.st #113, from jsan:
a comment to 112

Yes, here's an argument.

The Atari bouncing-ball demo is running *flat out*, using every trick in the book to get its speed and smoothness working. It is using 100 per cent processor time, and so nothing else could be working at the same time, nor could two or three bouncing balls be working at the same time.

The Amiga bouncing ball, on the other hand, is done using total *hardware* register modification. What that means is that not only the ball's spin, but even its *movement* is done without any loss of processor speed or software. It *moves* the instant that the bit-plane Start registers have been altered, whereas the Atari one must block move the entire beachball in order to make it move. The bottom line is that the Amiga bouncing demo is an incredible effect, considering it's using a *negligible* amount of processor, whereas the Atari gains the effect working *flat out* as hard as it can!

The Amiga can, of course, pull up a screen in front of or *behind* that bouncing ball, and the user can pull the screen up or down interactively with the mouse while the ball is still bouncing (and boinging in stereo, I might add!). The Atari cannot do that, as it has no hardware registers at all, except for a Palette.

The reason the Atari ball appears to spin faster is that Atari used fewer colors to define the ball, half the number that the Amiga version used; thus the Amiga one spins smoothly—much more smoothly than the Atari version ever could.

Having said all that, I'm *very* impressed that the Atari programmer managed to get it Sooo Good on an ST! I didn't think that kind of graphics was possible on an Atari. He must have done pretty well!

atari/news.st #159, from duck [Dale Luck, Commodore-Amiga]:
a comment to 158

It was probably running faster because that is the way the programmer wanted it. It looked *very* nice.

atari/non.tech.st #117, from duck

The first Amiga version was programmed between the hours of 12 midnight and 4 a.m. on about January 7, 1984. Although the initial spinning ball had been created some time before then.

About May, another 8 hours was devoted for sound and left-right bounce effects. Once the demo was running, little was done to make it

faster; it seemed to create the right effect.

[Editor's note: For further comment from the staff at Commodore-Amiga, see the comments of Bob Pariseau in *Best of BIX—Amiga*.]

DEGAS

atari/news.st #117, from rsimonsen [Redmond Simonsen]:
comment to 115

[Editor's note: This dispatch is in response to comments by thud, Tom Hudson, who implemented DEGAS.]

If you plan the program for use by both casual *and* serious users, joystick, mouse, and tablet support is really desirable. Serious drawing requires a stylus-like instrument. Unfortunately, such tablets are not cheap, therefore not widely owned nor supported by commercial software.

By way of a compliment, your program made me feel better about the potential of the 520ST, and I'm now actively rooting for its success. know how feature glut can make one freeze in anticipation of all that revision. But press on.

I am struck by a false separation in software categories between "paint" programs and "drawing" programs (with the latter being more elaborate and expensive and usually object-oriented). To artists and architects, there is little to applaud about such a dividing line in technique and approach to putting images on the screen.

Speaking of screens, is that of the ST orthogonal; i.e., does the distance between vertical pixels equal the distance between horizontal pixel positions? If not, does your program compensate for the appearance of images on the screen versus the same output on a printer? My PC Paint does not and it's very annoying. Moreover, mathematically correct circles are visually incorrect on the screen of my AT&T 6300 (they look like ellipses) but correct when printed (but all the freehand stuff in the drawing gets squashed, of course). Graphic software for machines like the ST ought to be sophisticated enough to compensate for these differences.

atari/news.st #119, from thud [Tom Hudson]:
a comment to 117

DEGAS generates true circles on the ST, as far as the *x* and *y* size is concerned. Unfortunately, the screen shows them as *slightly* elliptical. Outputting the picture to a printer or plotter with a correct aspect ratio will correct it (but, as you say, freehand drawing will be squashed). It's a no-win situation.

atari/news.st #120, from rsimonsen:
a comment to 119

Why can't DEGAS have an intelligent picture processor that remaps the picture to compensate for the peculiarities of various printers? All drawing on the screen should be done on a "looks right" basis (i.e., circles are *not* *x,y* correct, but they *look* right). When the picture is printed instead of doing a simple screen dump, the picture is redrawn into a RAM buffer with the *y*-axis appropriately scaled to compensate for the particular printer being used. Sounds like pretty simple software to me.

I wrote a turtle-graphics system on the Apple II (in FORTH) that did circle and polygon compensation on the screen. I didn't do a printer output processor, but all you'd have to do is rotate the bit map and rescale the now-horizontal lines. Correct?

atari/news.st #121, from mdulcey [Mark Dulcey]:
a comment to 120

It's not that simple. The catch is that scaling the bit map like that (especially by a small scale factor) will lead to excessive jaggies on

(continued)

some objects. Remember, you want the *text* to print correctly, not just the circles and polygons.

The *real* solution would seem to be for Atari to adjust the monitors so the aspect ratio is correct. The pixel counts are appropriate for this, given the size of the screen.

atari/news.st #139, from al:
a comment to 121

No, no, the *real* solution is device independence.

atari/news.st #123, from rsimonsen:
a comment to 121

Actually, I assert that it *is* that simple. It should at least be attempted and tested. Yearning for Atari to change their monitor is a cop-out, since they'll never do that to address this problem.

atari/news.st #125, from thud:
a comment to 120

Actually, DEGAS doesn't do a raw screen dump but uses special printer drivers that may scale the output any way they like. Therefore, in theory, all the printers/plotters could have perfect aspect ratios, as long as they were written properly. In practice, though, most dot-matrix printers give trouble, because their pin-spacing/linefeed ratios aren't infinitely variable to provide accurate scaling. Somebody give me a laser printer.

atari/news.st #126, from thud:
a comment to 123

It could be done to a certain extent, but your average, casual computer user isn't going to care about it that much. Plus, the cost for the additional factory alignment would probably be a no-no for Atari right now. Not to mention the in-the-field variables involved.

atari/news.st #128, from rsimonsen:
a comment to 125

Regarding scaled pictures: On my AT&T 6300 using PC Paint, the ratio of depth to width is 1.2; i.e., a square box (in terms of pixels) measures (with a ruler) 20 percent deeper than its width. I presume it's something similar on the 520ST. What should happen with regular polygons, circles, et al., is this:

1. The on-screen image is presented as visually correct (so, for example, a square 100 pixels wide would only be 83 pixels deep). This would make it look correct on the screen.
2. When printed (presuming we have a printer that spaces its dots evenly in both directions), the image is first rotated 90 degrees in memory, and then the bit string is scaled by 1.2, then printed.
3. Printers that were incapable of producing a truly square grid of dots would have the picture processed by a scaling factor that approximated their aspect ratio.
4. The user would be given the option of printing the picture without processing.

Since the greatest use of pictures is "on screen," it is important to be able to produce geometric figures that look geometric and can be easily made so (as opposed to the approximation methods one must now resort to by twiddling with the mouse-cursor).

atari/news.st #131, from mdulcey:
a comment to 128

This procedure won't produce optimal results in all cases. Suppose I carefully design a font to use only straight and diagonal lines (say I

don't like jaggies). After this is scaled, it won't look right anymore.

There are only two good solutions:

1. Use object-oriented draw software.
2. Use monitors with the same aspect ratio as the printer.

atari/news.st #138, from al:
a comment to 117

Of course, he said, climbing onto a convenient soapbox, if such "paint" and "draw" programs simultaneously saved away a list of the instructions used in creating the image (in a convenient notation like NAPLPS, hint, hint), then circles would be circular whatever the output device.

Rather than simply transfer the screen bit map to the printer (and end up with aspect-ratio problems), simply pass the NAPLPS file to an appropriate printer driver, and there you are.

(And you have the added benefit of being able to send the pictures over phone lines in reasonable amounts of time—and displaying them on otherwise incompatible computers.)

See also (plug, plug) the conference Graph.exch, particularly the "naplps" topic.

IBM

This month we are featuring the discussions in the MS-DOS conference. The section on DOS commands focuses on FORMAT errors and use of the RESTORE command. Another discussion covers hard-disk slowdowns.

MS-DOS COMMANDS

ms.dos/commands #90, from mose [Michael Mosely]

Backup using DOS 2.0: Help, please. Awhile back I used the BACKUP command to back up a directory or two using DOS version 2.0 on an IBM PC XT. Today I tried to restore them using "RESTORE A: C:." Well, the system clicked and whirled and told me there were no files to restore. DIR finds all of them including the BACKUPID.@@@ file. I'm kind of stuck because I can't even do a straight COPY operation and have my .EXE file execute. The files copy okay with the same number of bytes and all, but when I try to run them the system complains about not having enough memory. BACKUP must diddle something. Can anyone offer advice or sympathy?

ms.dos/commands #91, from petewhite [Pete White]:
a comment to 90

If you were backing up a subdirectory, try the "/S" option. Other than that, RESTORE should work.

ms.dos/commands #92, from rich [Rich Sidney]:
a comment to 90

Try

C>RESTORE A: \ *.* C:/S

You have to tell RESTORE which files to restore. It does *not* assume any files. As you gave it a null filename, it restored nothing.

ms.dos/commands #95, from kebrown [Ken Brown]:
a comment to 90

You will not be able to just copy the files off the backup disk, you

(continued)

SOFTWARE • BUSINESS

dows that display top, front, and side views, as well as an axonometric projection of the object. Below the windows, an information strip displays various values of the object you're designing—its perimeter, surface, geometric quotes, or choice of drawings proposed.

MacSpace works with the Imagewriter and LaserWriter printers and can transfer drawings to MacPaint, MacDraw, and other graphics and drawing programs. It can also send output to a variety of Macintosh-compatible plotters.

The program runs on the 512K Macintosh and costs \$385. Contact Abvent, 9903 Santa Monica Blvd., Suite 268, Beverly Hills, CA 90212, (213) 659-5157. Inquiry 591.

Low-Cost Word Processor

WPro, a word-processing program for IBM PCs and compatible computers from Natural Language Inc., features a two-level interface designed for beginning and experienced computer users. You can customize and extend the interface with the macro definitions the program provides.

WPro has built-in forms management, windows, mail merge, label printing, concurrent print spooling, translation tables for foreign languages, automatic indentation, the ability to execute external programs or commands, and the ability to display directories. The program can combine text with images generated by business graphics and drawing programs. WPro can also import and export data to and from spreadsheets and database programs.

The program supports multiple fonts and runs on a variety of laser, dot-matrix, and daisy-wheel printers. WPro retails for \$96 and runs on IBM PC and compatible computers with 256K bytes of RAM. For more information, contact Natural Language Inc., POB 13467, Kanata, Ontario K2K 1X6, Canada, (613) 820-8299. Inquiry 592.

Graphics Database for CAD

Micro-Vector's CADRover is a graphics database program that finds and retrieves stored images you've created with other CAD packages. Designed for presentation, CADRover lets you arrange and display drawings in sequences. If you specify one or more points in a drawing, the program activates these points to display selected images in an order you define. The program can also link graphics with text.

CADRover can read a variety of file formats used by other applications programs and currently reads files produced by CAD-Master and VersaCAD. Selling for \$495, the program runs on the IBM PC and compatibles. Contact Micro-Vector Inc., 1 Byram Brook Place, Armonk, NY 10504, (914) 273-8700. Inquiry 593.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, 70 Main St., Peterborough, NH 03458.

Software for Speeding PC ATs

Dynamical Systems' software utility, AT Speed-Fixer, facilitates speeding up an IBM PC AT. The package consists primarily of a memory-resident program designed to prevent disk-drive errors that might occur with an AT running faster than 6 MHz. Also on the disk is a utility that increases keyboard speed by reprogramming the chip inside the AT keyboard.

Along with the software come instructions on how to speed up an AT by replacing the crystal and how to quicken a hard disk used with an accelerated AT.

AT SpeedFixer costs \$24.95. For more information, contact Dynamical Systems Inc., 2511 Fulton St., Berkeley, CA 94704, (800) 227-2400, ext. 929. Inquiry 594.

Atari ST Graphics Software

DEGAS, from Batteries Included, runs on the Atari 520ST and 1040ST. The program incorporates GEM and adjusts to whichever ST graphics mode you use.

Within DEGAS, you can employ drawing functions; choose your colors; design your own brush, fill, and line patterns; and use magnify.

shadow, mirror, and airbrush features. The mouse acts as paintbrush or pencil, and a click can move you between the main menu and the drawing screen. The program allows combined text and graphics and lets you create your own text fonts.

The results of work with DEGAS can be printed on any Epson or compatible graphics printer. DEGAS costs \$39.95 U.S. (\$54.95 Canadian). Contact Batteries Included, 30 Mural St., Richmond Hill, Ontario L4B 1B5, Canada, (416) 881-9816. U.S. sales: 17875 Sky Park North, Suite P, Irvine, CA 92714, (714) 250-8723. Inquiry 595.

CP/M for MS-DOS Computers

RUN/CPM, from Micro Interfaces, is packaged with NEC's V20/V30 micro-processor and is designed for running CP/M software on the IBM PC and compatible computers. In addition to being compatible with Intel's 8088 and 8086, the NEC microprocessor provides instructions for Intel's 8-bit 8080.

The software's features include 15 logical and physical drive assignments, support for subdirectories and path-name assignments, terminal emulation for many CP/M terminals, a disk-transfer utility for transferring CP/M software to MS-DOS format, and the ability to issue MS-DOS commands in CP/M mode.

RUN/CPM sells for \$99.95 and includes software, the NEC V20/V30 microprocessor, and documentation. Contact Micro Interfaces Corp., 6824 Northwest 169th St., Miami, FL 33015, (305) 823-8088. Inquiry 596.

Hi-Res Color Workstation Runs Two UNIX Standards

Apollo Computer's Domain Series 3000 Personal Workstation combines 32-bit computing, high-resolution color graphics, and integrated networking capabilities. The workstation comes with Apollo's Domain/IX software, which is based on AT&T's UNIX System V and enables that UNIX and Berkeley 4.2 to run as coresident operating systems.

The Series 3000 uses the 68020 processor and 68881 floating-point chip. Memory capacity ranges from 2 to 4 megabytes, and large-program capability is provided by 64 megabytes of virtual address space per process (for as many as 24 processes).

Equipped with an external bus that's compatible with the IBM PC AT, the workstation has six 16-bit slots and two 8-bit slots. Apollo says it has in the works a co-processor for running IBM PC applications.

The color versions of the Series 3000 offer resolution of 1024 by 800 pixels on a 15-inch monitor; the basic model, with 2 megabytes of main memory, costs \$14,900. The monochrome models offer resolution of 1280 by 1024 pixels on a 19-inch monitor; the basic version, with 2 megabytes of main memory, costs \$9900. For more information, contact Apollo Computer Inc., 330 Billerica Rd., Chelmsford, MA 01824, (617) 256-6600, Inquiry **550**.



Apollo's Domain Series 3000 Personal Workstation.

CD-ROM Hardware with Encyclopedia Disk

Activenture's Personal Information Package consists of a CD-ROM player, a controller card and connecting cable, the Grolier Electronic Encyclopedia on a compact disk, and software that lets you search for and retrieve information. The system works with IBM PCs and compatibles having at least 256K bytes of memory.

With the Knowledge Retrieval System (KRS) software, you can search—by

word, name, phrase, or topic—the disk version of the 21 volumes of Grolier's Academic American Encyclopedia. According to Activenture, locations of any word (there are more than 9 million of them) in the encyclopedia can be found in seconds through KRS.

The ROMulus CD-ROM drive has a data capacity of 540 megabytes per disk and can be connected to any IBM PC, XT, AT, or compatible through a controller card that fits in an open expansion slot.

The complete hardware/software package sells for \$995, but you can buy just the CD-ROM player and controller for \$849 and the

encyclopedia disk/KRS software for \$199. Contact Activenture Corp., POB 51125, Pacific Grove, CA 93950, (408) 375-2638, Inquiry **551**.

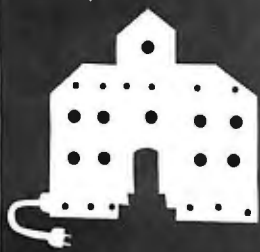
PC Board Designer for Atari ST

Abacus Software has a program for designing printed circuit boards with an Atari 520ST or 1040ST. PCBoard Designer, developed by Data Becker GmbH of West Germany, features an automatic routing capability. Traces are drawn automatically on the screen, and if you change your design, the trace can be immediately redrawn. Options allow for 45- or 90-degree angle traces, different widths, routing from pin to pin, from pin to bus, bus to bus, and two-sided boards.

You first define the components that are part of the board and enter the information at the keyboard. Next, you define the connections. Using the mouse, you then place the components on the screen. You can change or reposition the components or connections at any time.

PCBoard Designer prints the layout to any Epson or compatible dot-matrix printer. According to Abacus, printouts are suitable for photoetching. You can also print the component layout and a list of components and connections.

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C·O·M·P·U·T·I·N·G A·T C·H·A·O·S M·A·N·O·R

Jerry's Best of 1985 Awards

COMDEX

NEC

Perma Power

Atari 520ST

Amiga

CD-ROMs

FTL Modula-2

Turbo Editor Toolbox

Jerry's Awards

BY JERRY POURNELLE

December is a busy month at Chaos Manor. Everything happens at once. I've just returned from COMDEX. Christmas is coming. I've caught my customary attack of the flu. It's time for my 1985 Best of the Year awards; and since this will go in the April issue, it's also time for the Folly of the Year. Stand by.

COMDEX was hectic. The United States Space Foundation's annual meeting was in Colorado Springs for the first part of the week, overlapping COMDEX by three days. I spent an enjoyable afternoon with faculty and cadets at the Air Force Academy on Wednesday, but of course my luncheon speech to the Space Foundation came on the same day as the Hearst/Pournelle/Dvorak COMDEX party in Las Vegas. I had things all planned out, but Colorado's weather bollixed things, so I found myself frantically changing planes. Even so, I didn't get to Las Vegas until about 9 p.m. Thursday evening.

I'd been told that the party was to be in the shopping mall of the Las Vegas Neiman-Marcus. This seemed unlikely, but there were no messages at my hotel, so off I went. When I got to the Fashion Mall, I found polite but astounded security guards, no one else, and no pointers to the real location. I was ready to strangle John Dvorak.

Still, one must cope. So at 10:20 p.m., having been escorted out of the Neiman-Marcus plaza, I set out to find the party I was supposed to cohost. An hour later I got to it. As I arrived, some people were leaving; far more showed up than anyone had expected, and they'd run out of drinks. That dire situation was soon remedied by Borland International's Philippe Kahn, who ordered champagne and pizza for all.

I'm told it was the best party of COMDEX. Certainly there were enough interesting people, including Microsoft's Bill Gates, Cap'n Crunch, editors in chief, writers and reporters, hackers, game designers, and Bixen (inhabitants of BIX). It was crowded enough that I never did find Will Hearst, nor

a number of others I wanted to see, but certainly it was The Place to be. I guess we'll do it again next year. I'd like to think it will be better organized, but it probably won't.

COMDEX

COMDEX is terribly expensive and getting more so. Every year there are more exhibits—or at least more square feet of exhibits. It's a bit like display advertising in leading magazines: companies simply can't afford not to be seen lest they be forgotten, not only by customers but by dealers.

Most companies don't have anything really new to show, but they *have* to be at COMDEX. The result is booth after booth distinguished mostly by gimmicks. One outfit has a yacht. Another has dancing girls. Yet another has grown people dressed up as children playing out a mindless skit. It's hard to find the genuine technological innovations among the magicians, vaudeville performers, ventriloquists, silly robots that whistle the theme from *Star Wars*, bowls of bubble gum, jelly beans, chocolate dollars, coffee cups, buttons, fuzzy animals, stick-ons, plastic back-scratchers, and other paraphernalia of hype. Still, the search must be made. Fortunately, there were some trends to be spotted.

One warning note: show reports describe what I saw at a show and what I concluded from things I was told. I don't make full reports on stuff until it's sitting here in Chaos Manor.

WONDERFUL WORLD OF COLOR

One thing stood out clearly: the future computer world will definitely be in color. Color has always been preferable to monochrome, but until recently, you couldn't get monitors and color cards to display text with enough sharpness and clarity. Now you can, and the best new text-editor software can take advantage of color, so that you can use, say, light-blue letters on a darker-blue background with yellow highlights, instead

(continued)

Jerry Pournelle holds a doctorate in psychology and is a science-fiction writer who also earns a comfortable living writing about computers present and future.

of white on black, or black on amber, or whatever.

Before this, I hadn't seen any affordable color display crisp enough that I could stare at it day after day; but there were several such systems at COMDEX. One of the most interesting was a neat monitor from NEC. It can display the output from the nor-

mal IBM PC color board (not really good enough for text), the Extended Graphics Adapter (which is getting there), or the Professional Graphics Adapter (which does have the capability).

NEC (1401 Estes Ave., Elk Grove Village, IL 60007) also has a new PC AT-compatible computer with some of

the best color graphics and color text I've ever seen. NEC wasn't alone, of course. In fact, it was hard to find a part of COMDEX that didn't have spiffy text-quality color displays; NEC just happened to be the first one to catch my eye.

One wonderful little gadget was unique, one of the most impressive items in the show. Perma Power Electronics Inc. (5615 West Howard Ave., Chicago, IL 60648), an outfit that you usually think of as making power-guard supplies, displayed a thin color-control box for less than \$300. It sits between your computer and your color monitor. Simple controls on the front let you instantly change the colors on your monitor to anything you like. Reds can become blues, greens become greener, or whatever. More to the point, you can change the whole palette from, say, your favorite word processor: different background color, different lettering, different highlight colors. I was really impressed with it at the show. More about it after I've had time to work with it here.

I came away from COMDEX convinced that, within two years, color will dominate the micro industry—and that includes business people as well as hobbyists, students, game players, and home users. Color is just too nice not to take advantage of.

ATARI

The Atari booth was over in West Hall, where crowds don't usually go, which made the ferment around the Atari booth stand out from a long way off. The Atari people brought in a bunch of software developers and set them up in minibooths reminiscent of the West Coast Computer Faire. The result was a bunch of enthusiastic young people showing what they could make the Atari 520ST do. You could get a contact high by just standing there.

I saw databases, text editors, games, accounting systems, languages and compilers, a light-show program, a music-recording program, and all kinds of other stuff. Atari wanted to

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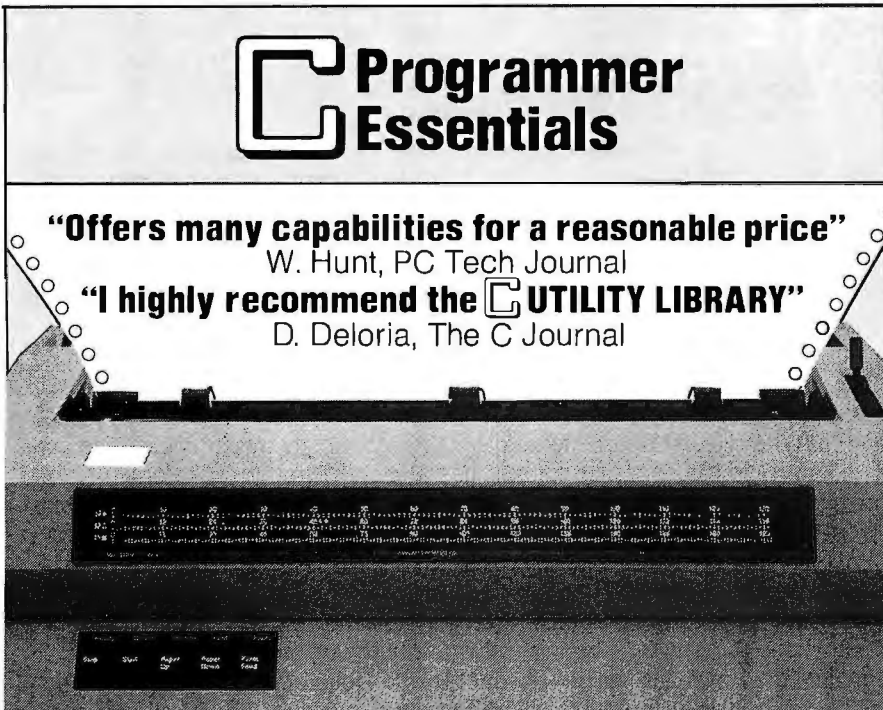
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scotch the rumor that there's no software for the 520ST, and, in my view, they succeeded with a vengeance. I think that the Atari 520ST is here to stay.

AMIGA

The Commodore folks were not at COMDEX. They'd reserved space but didn't use it; instead, they held a press conference. The official line was that Commodore is selling all the Amiga computers it can make and thus has all the dealers it needs; it would be silly to spend all that money just to tell potential dealers they can't come aboard.

Atari's comment on that was, "We sell more Atari 520STs than Commodore sells Amigas, and we sure want to sign up more dealers." The rumor in the pressroom was that Commodore's bankers were signing its checks and wouldn't advance the money to pay for COMDEX.

I wouldn't know. What I do know is that the Commodore Amiga is one hell of an exciting machine.

AMIGA VERSUS ATARI 520ST

I've had an Atari 520ST and an Amiga set up side by side for about a week. One thing is clear: either one of these machines could eat Apple's lunch. Both machines have sharp, crisp color graphics. Neither one has a text editor good enough that I'd use it to write books, but that's a software problem: both the Amiga and the 520ST can display professional-quality text in color. It shouldn't be long before someone writes editors transparent enough for creative writers. Indeed, we already have TDI Modula-2/ST up on the Atari, and it wouldn't take a heck of a long time to write a good text editor.

In addition, both the Atari and the Amiga have versions of EMACS, the popular programming editor written by Richard M. Stallman. I haven't worked with the current versions, but real EMACS can be customized to know what language you're programming in, making the programmer's life much easier.

By the time you read this, both ma-

chines will have Lattice C. Lattice also has a bunch of software tools, like Text Utilities and MacLibrary, a collection of C functions compatible with Macintosh QuickDraw. Software developers are enthusiastic about these: they make it easy to convert Macintosh software to the Amiga. Meanwhile, Borland is porting Turbo Pascal to the Amiga, and, as I've already mentioned, we have TDI's Modula-2 for the Atari. The Amiga's Microsoft BASIC is, as I write this, greatly superior to the Atari's present BASIC, but once again things are changing rapidly. Metacomco, a reliable outfit, is working with Atari, and its Personal BASIC ought to be up on the Atari well before you read this. Moreover, Metacomco is also working with Lattice to bring Lattice C and Toolkit to the Atari. There won't be any shortage of programming languages for either machine.

Amiga has one major advantage. Microsoft is emphatic about having no plans whatever to port anything to the Atari; but Microsoft's Excel is still the best spreadsheet on the market, and by a lot. The 520ST with Excel would be a dynamite combination and would practically guarantee Atari's penetration into the business world. Excel is written in C for the 68000-based Macintosh, and both the Atari and the Amiga are 68000 machines; it wouldn't be that hard to get Excel onto either one.

The story I get is that Atari was originally going to run with Microsoft Windows, but when Microsoft didn't have Windows running in time for the 520ST's release, Atari went with Digital Research's GEM, which irritated Microsoft no end. Whatever the story, you're likely to see Excel on the Amiga long before it gets to the Atari 520ST. It'll be a good combination, too. Meanwhile, there's already powerful business software for the Atari, including DB Master and Quickview's Zoomracks.

In my judgment, the Atari and the Amiga between them spell big trouble for Apple. I haven't seen anything you can do with a Macintosh that you

(continued)

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CHAOS MANOR

can't, at least in theory, do as well with either of these two machines. Hackers assure me that it's much easier to write programs for either than for the Mac—one chap told me he could get a fancy program running on *both* the Atari and the Amiga quicker than he could get it going on the Macintosh. There are powerful languages for both machines. Both companies have sensible policies to encourage software developers, and both are really working to be nice to hackers. It shouldn't be long before the floodgates open and the software pours out. There will still be Macintosh loyalists, of course, and Apple is likely to cut Macintosh prices; but the Mac's small and colorless screen, inherent speed limitations, and lack of disk controller will count against it.

Both the Atari and the Amiga will, or at least ought to, do well against the Apple II and the Macintosh. The real question is how they'll compete with each other.

I think it's too early to tell. Each machine has strengths and weaknesses. The Amiga has multitasking. Its keyboard definitely feels better, and its color graphics are, I think, aesthetically nicer. The Amiga is also easier to set up. The Atari needs a lot of room, has cables *everywhere*, and really requires simple but specialized furniture to be useful. However, its color monitor is better than the Amiga's; to get the best from the Amiga, you will want a Sony monitor or something similar. The Atari has good sound quality, but the Amiga has even better and in stereo. And so forth.

I suppose I prefer the Amiga to the Atari; but *how much* do I prefer it? The price difference between the machines is significant, especially when you consider that the Atari will soon have a \$700 20-megabyte hard disk, and many of the Amiga's hardware features can be simulated in the Atari through clever software. The Amiga is, on balance, the "better" machine—but the Atari 520ST is certainly good enough for a lot more than I originally bought my first computer for.

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My guess is that the Amiga will appeal more to serious computer users—professional artists and writers, hackers, dedicated hobbyists—while the Atari will be the machine “for the rest of us,” meaning the machine that everyone can afford. I wouldn’t be surprised to see a significant portion of U.S. high school students owning Atari

520STs before the end of this decade. The machine is that good, and Atari’s policy is ruthlessly to cut costs and prices.

The nice part is that the Amiga will keep Atari on its technological toes; the Atari will force Commodore to keep prices down; and both will force Apple and IBM to pay attention to

something besides horoscopes and hype. The rest of us can’t lose.

AT LEAST ONE CPU...

I don’t believe in multiuser micros. “One user, at least one CPU” is Pournelle’s motto. If you want multiple users, get multiple machines and network them.

My philosophy seems to be catching on. IBM introduced the PC AT as a multiuser machine, but it isn’t often used that way. There probably were some, but I don’t remember seeing one multiuser PC AT at COMDEX. On the other hand, I saw a lot of PC AT clones set up to do multitasking for single users.

That doesn’t surprise me a lot. I’ve been using Big Kat, the Kaypro 286i, since last spring, and I would truly hate to go back to a less powerful machine. Big Kat is fast and, barring the hard-disk problem I previously reported, has never had a glitch.

Big Kat doesn’t have enough memory. That is: the machine is full up with 640K bytes, but that’s not enough for everything I want to do, what with SideKick, SuperKey, the Turbo Lightning spelling checker, Symantec’s Q&A editor and report generator, and Living Videotext’s Ready! outline processor.

There are solutions. Wayne Holder, whose Oasis Software brought you The Word Plus, has developed a new spelling checker and thesaurus program that works with Q&A. Symantec continues to work to reduce the program’s memory requirements. Ready! will currently run on an expanded-memory board, and Gordon Eubanks assures me that Symantec is working hard to get Q&A to do the same. Meanwhile, a number of companies offer expanded-memory boards for the PC AT and its clones.

There are enough outside sources of both hardware and software for the AT to reach a critical mass. Indeed, I think it has already happened. The AT and its clones have become the new “standard” small business computer, and, from here on, more and more programs will take advantage of the

(continued)

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minor one so far. Also, Tom is planning on lots of improvements and extensions. TML Pascal has now become my standard development language on the Mac and will probably remain so for the foreseeable future.

C ON THE MAC

This, of course, doesn't mean I've given up on C. It's just too pervasive a language to ignore. Besides, version 4.01 of Mac C from Consulair Corporation (a.k.a. Bill and Ann Duvall) just showed up, easing the pain of learning C. The development environment is similar to that of TML Pascal (editor, compiler, linker, RMaker), with a few notable exceptions. First, the Transfer functions are more intelligent. If I edit a file named BENCH.C, the Transfer menu will give me "C Bench.C" as one of the options. So I can compile it without having to specify the filename. If I want to compile some other file, I simply close BENCH.C, and the Transfer menu gives me just "C" as an option. Second, the Exec program lets me do simple batch processing, which is useful for linking a number of .REL files. Third, the Transfer menu has "compile and go" and "link and go" options, which help cut down the number of steps during the compile-link-run cycle.

Mac C maintains a certain amount of compatibility with the Apple MDS assembler. You can use the Mac C linker to link in .REL files produced by MDS, but you can't use the MDS linker to link in .REL files produced by Mac C. However, since Mac C contains its own assembler (for both in-line and separately assembled routines), and since the Mac C linker is an "intelligent" linker (copying in only the code needed instead of the entire library), you don't really need MDS at all.

Mac C comes with four disks, three manuals, some update sheets, and a hefty price tag of \$425. However, of all the C compilers on the Mac that I've used (including Megamax, Aztec, and Hippo), I prefer Mac C. It's what I'll be using from now on...when I'm not using TML Pascal.

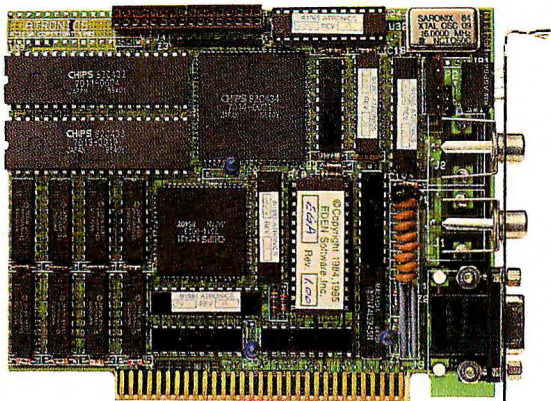
To help me along with Mac C, a close friend of mine—Frank Boosman—gave me a book for Christmas: *Using the Macintosh Toolbox with C*. It's written by Jim Takatsuka, Fred Huxham, and David Burnard and published by Sybex at \$22.95. The book is thick (more than 500 pages), has lots of sample code, and, from what I can tell, does *not* require that you own *Inside Macintosh*. Best of all (for my purposes, anyway), all the examples are written using Mac (Consulair) C, though the authors say they tried to make the code as compiler-independent as possible. The book has already solved one problem that was plaguing me in a benchmark program and, I suspect, will make life much easier for me. If you're going to program in C on the Mac, this book is probably worth owning.

ATARI 520ST SOFTWARE

Many programs for the 520ST have shown up in the past few weeks. In terms of sheer numbers, MichTron Inc. seems

(continued)

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to be the winner. Five packages have shown up so far. The three most important are all system utilities written by Timothy Purvis. M-Disk is a RAM-disk package for the ST, which I haven't bothered to use yet since I still don't have TOS/GEM in ROM (and so have only about 256K bytes of RAM free). It should be great on a 1-megabyte ST, though. Soft Spool is a printer spooler to let you quickly complete a printing job and get back to work while the document is still printing. It uses a RAM buffer, so again this would work best with an ST with TOS/GEM in ROM. MichTron Utilities has two programs: a disk editor, which lets you view and change any byte on a disk, and a disk-copy program. The last two, Mudpies and Flip Side, are games; Mudpies is a cute but uncomplicated arcade game, while Flip Side is an ST implementation of Reversi. (Incidentally, Flip Side works with both color and monochrome monitors, while Mudpies works only with color.)

Mirage Concepts Inc. has two products out under its Holmes & Duckworth product line: Forth and Toolbox. I freely admit that I have used the Forth only briefly—I've had too much else to worry about the past few weeks to wrench my mind back into the RPN (reverse Polish notation) mindset—but the documents (55K bytes, distributed on the disk) give me the feeling that this was written by the programmers to satisfy themselves and so is probably a decent implementation. I've played around a little more with Toolbox, which has five programs in it: a disk editor (file or track/sector); a memory editor; a deleted-file-recovery program; a format-and-copy-disk program; and a directory-print program (seems there's no easy way to get a complete directory listing on the computer from GEM). In short, these are five very useful programs for anyone digging into the guts of the ST. All programs work with both monochrome and color monitors.

The best of the ST software so far is DEGAS, which stands for Design and Entertainment Graphic Arts System. Briefly put, it's painting software. Written by Tom Hudson and published by Batteries Included, DEGAS is the perfect "What does it do?" program for the 520ST. The user interface is simply a screen full of labeled buttons, so you don't have to do any icon decryption. The left button on the mouse lets you select buttons or perform actions; the right button switches you instantly between the buttons and your drawing.

DEGAS is full of features: points, lines, shapes (frames and solids), brushes, fill patterns, shadows and mirrors, and a lot of "design your own" power (including a separate font editor). Response time is fast, the manual is well written (but largely unnecessary—a tribute to the program's user interface), and it's just a great program. Best of all, it works on both color (16 colors from a palette of 512) and monochrome monitors, which a lot of ST software (including the public-domain painting program NeoChrome) won't.

The easiest way to put it is this: If you own an ST, you should buy DEGAS. And please *buy* it. The folks at Bat-

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teries Included were trusting enough not to copy-protect DEGAS and sensible enough to sell it for a fair price (\$39.95). Please don't abuse that trust by getting it from a friend or letting a friend pirate your copy. And, no, I have no connections whatsoever with Batteries Included or Tom Hudson; I would just hate to see them both get ripped off by a bunch of thieves.

AMIGA SOFTWARE

As mentioned last month, Amiga software has just started to hit the shelves. In the past week, I've received about a dozen programs, all coming from just two publishers: Electronic Arts and Lattice.

As with the ST, the best Amiga program so far is a painting program: Deluxe Paint, written by Daniel Silva and published by Electronic Arts. Deluxe Paint is reminiscent of MacPaint—a menu bar across the top, icons along one side—but there's a big difference: color. And lots of it.

What really makes Deluxe Paint stand out are its features. Let's start with the color palette. In low-resolution mode (320 by 200 pixels), you can have 32 different colors (out of a possible 4096). Like DEGAS, you can individually adjust each color. But the palette's functions don't stop there. You can select any two colors on the palette and have it automatically generate a set of intervening colors. For example, if color #5 is pure red and color #15 is pure green, the spread function will turn colors 6–14 to shades that go from red to green—in this case, passing through orange and yellow along the way. I was able to easily generate a "rainbow" palette by creating the classic rainbow colors (red, orange, yellow, green, blue, indigo, violet) at regular intervals, then using the spread function to create intervening shades. Like DEGAS, you can set up a range of colors to cycle through; unlike DEGAS, you can define up to three different cycle ranges, each with its own speed.

As for painting, you have most of the tools found in MacPaint and DEGAS—like lines, filled and framed shapes, etc.—and quite a few found in neither, like the ability to do smearing, shading, or blending of the colors. You can grab any rectangular portion of the screen and use it as a brush. You can save and load brushes, which gives you an effective "clipboard" for saving chunks of pictures.

Comparing DEGAS (on the ST) and Deluxe Paint (on the Amiga) isn't easy, if simply because they are on two different computers. I prefer the two-screen user interface of DEGAS; it's easier to learn and a bit less cryptic. Deluxe Paint, on the other hand, has significantly more capabilities and options. Just about everything that DEGAS lets you do, Deluxe Paint lets you do in more ways and with more options, though there are a few things that DEGAS does better (or that Deluxe Paint just doesn't do). And like DEGAS and the ST, Deluxe Paint is a program you should buy if you own an Amiga.

Three of the remaining EA programs are games: Seven Cities of Gold, One on One, and Archon. Unfortunately,

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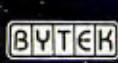
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*I didn't say much last month
about COMDEX, mostly
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The industry seems to be
a little healthy, if dull.*

all three require a joystick, or at least work a heck of a lot better with one. More on these once I can scrounge up a joystick. The remaining EA program, Financial Cookbook, will probably get covered in a later column; I have an aversion to financial software that I must overcome first.

The software from Lattice is all geared toward development (i.e., a C compiler, a "Mac Library," and so on). I'll report more on this next column, since I'll probably convert all my benchmarks over to it.

NOTES AND COMMENTS

I didn't say much last month about COMDEX, mostly because there wasn't a whole lot to say. The industry seems to be a little healthy, if dull. The three most interesting things I saw were Atari's booth, which was crowded with third-party software displays; Commodore's booth, which was noteworthy in that it didn't exist; and the Levco 2-megabyte Monster Mac upgrade being shown in (of all places) the Apple booth. The latter was remarkable, given Apple's past attitude toward third-party memory upgrades; it also gives me hope for Apple.

The Mac Plus and the Atari 1040ST should both have been announced by now. The two machines are remarkably similar: 1 megabyte of RAM; a built-in double-sided 3½-inch disk drive; high-resolution monochrome monitor; a large ROM (128K bytes for the Mac Plus, 192K bytes for the 1040ST); 68000 processor; mouse; large keyboard with cursor keys and numeric keypad. The big difference is price: \$2495 for the Mac Plus, \$995 for the 1040ST. And, of course, the 1040ST has built-in color graphics and a faster clock speed. Some of you may be asking yourselves, "Why does the Mac Plus cost so much more than the 1040ST?" Good question. Wish I knew the answer.

Speaking of the ST... Atari says that with the introduction of the 1040ST, the 520ST will be unbundled and sold through the mass market (K-Mart, etc.) for \$299. Of course, since it's nearly impossible to hook up anything but an Atari monitor to it, and since the machine is basically useless without a disk drive, the cost for a working system (monochrome) will be about \$700. You're probably better off spending the extra bucks and just getting the 1040ST. Also, my memory may be playing tricks on me, but didn't Jack Tramiel spend most of 1985 swearing up and down that he was *not* going to sell the ST through the

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mass market? I wonder how dealers are going to react to all this.

COMING ATTRACTIONS

Okay. Next month for sure, the benchmarks on the Mac, the Amiga, and the 520ST. . . and, if I can, on the Mac Plus and the 1040ST as well. Maybe some more software reviews—I've got a stack of Mac and IBM software I haven't touched yet. And whatever else comes this way. Until then, see you on the bit stream. ■

PRESERVING PREFERENCES

amiga/main #1173, from mbutler [Michael Butler]

Am I missing something, or is there really no standard place in RAM to squirrel away the color table?

I'm particularly interested in being able to tidy up the first four palette entries (i.e., the Workbench colors) when my code is finished running. The hardware manual says that the actual registers are write-only, and I believe that, but is there no stock way of recovering the stuff done in Preferences?

Are the contents of the disk file updated by Preferences laid out in such a way that mere mortals may view them? Are there standard symbolic names in some #include, or some such? RJ? Pariseau? Anybody?

Also, I too would *really* appreciate more documentation on device drivers and printer interfaces. There are some nifty serial chips that are crying out for a side-board.

amiga/main #1174, from duck:
a comment to 1173

Try GetRGB4 where:

(vp,index)

vp = viewport of the Workbench screen

i = 0-3 for Workbench

Returns 12-bit value.

amiga/main #1175, from mbutler:
a comment to 1174

Far out. Thanks! Could you tell me which include file that's in? Thanks again.

amiga/main #1177, from duck:
a comment to 1174

I made a mistake, I think GetRGB4 takes a color map. You can get that from viewport->ColorMap. If you can find the Workbench screen you'll notice a viewport in there. GetRGB4 is a graphics.library function.

amiga/main #1179, from rjmical [R. J. Mical, Commodore-Amiga]:
a comment to 1177

If you aren't opening a window in the Workbench screen, you have no way of getting at the screen's viewport. But there's an easier way to get the default Workbench colors:

Call GetPrefs(), the Intuition function that returns a block of data containing the current system preferences. The data structure is named Preferences (surprise! could you guess? simplicity!) and can be found in the file intuition.h. The GetPrefs() function can be found in the Intuition manual.

amiga/main #1183, from duck:
a comment to 1179

The GetPrefs function only returns the user's preferences, it does nothing to return the current Workbench screen colors if someone else has dickered with them. The GetPrefs only works for Workbench and is not able to handle any screen that you may want to restore colors to after you have changed them.

ATARI ST

This month the ST discussions concern switching resolutions, experience with different versions of C and assemblers, installing TOS in ROM, using the VT52 on the desktop, I/O on the joystick port, printers, alternative disk formats, and the limitations of ST windows. Enthusiasts of Star Raiders will appreciate Jerry's closing fervor.

SWITCHING RESOLUTIONS

atari/tech.st #143, from cheath [Charlie Heath, MicroSmiths]

Is it really impossible to change from low to medium resolution on the color monitor without rebooting? It is possible to toggle the hardware, but the VDI routines will not work. We spoke to Atari and DRI and that

DEVICE PROGRAMMERS,



was the conclusion. This means it is impossible for a program to switch between a 16-color low-res graphics display and an 80-column text display. We are shocked, as our current contract job requires the switch.

atari/tech.st #144, from jtittsler [Jim Tittsler, Atari Corp.]:
a comment to 143

You might try doing a close physical workstation call after you have toggled the hardware (with the extended BIOS function call). Then reopen a physical workstation, and theory says VDI will catch on to the new resolution. (This should work within your application, but exiting to the desktop after doing this may be a problem.)

atari/tech.st #146, from jsan [Jez San, Argonaut Software]:
a comment to 143

It's perfectly possible for a program to change between low-res and hi-res quickly and easily. All that is required is a quick mode change on the system register "shiftmd" (Video Shift Mode type).

This is perfect for a hardware point of view, and we use it in our game. The problem comes when you want to use GEM, which was not designed to work in multimode environments! I'm sure someone will figure out a "naughty" (dirty) way of poking GEM's variables to fool it into changing modes, but in the meantime, I know of no *legit* way of doing it.

atari/tech.st #150, from cheath:
a comment to 148

Re: Switching resolution. We tried the "Close workstation; set hardware to other mode; Open workstation," and it doesn't work with the VDI routines.

I/O OPERATIONS

atari/tech.st #50, from skrenek [Steve Krenek]

Can the ST do anything during an I/O operation (like the Amiga) or does it wait until the I/O is complete to proceed (like the Atari 800)?

atari/tech.st #145, from jtittsler:
a comment to 50

Yes, the ST can do some operations during disk I/O operations. This is due, at least in part, to the way the DMA chip buffers the data arriving from the disk (either through the internal floppy controller or the external DMA port). It will request the 68000 bus only when it needs to empty its internal FIFO, leaving the 68000 largely unencumbered even during DMA.

Cs AND ASSEMBLERS

atari/tech.st #205, from aloveyjo [Alan Lovejoy]

I would like to know what compilers are available and about their quality.

atari/tech.st #208, from neilharris [Neil Harris, Atari Corp.]:
a comment to 205

C compilers: Alcyon C, sold directly by Atari as part of developer's package.

Hippo C, from Haba Systems.

Lattice C, coming soon from Metacomco and sold by Antic in the U.S.

Megamax C, almost out.

Modula-2: TDI Systems, Dallas, TX (written in England).

BASIC: FAST/BASIC, coming soon from Philon.

Pascal: Personal Pascal from OSS, native-code compiler.

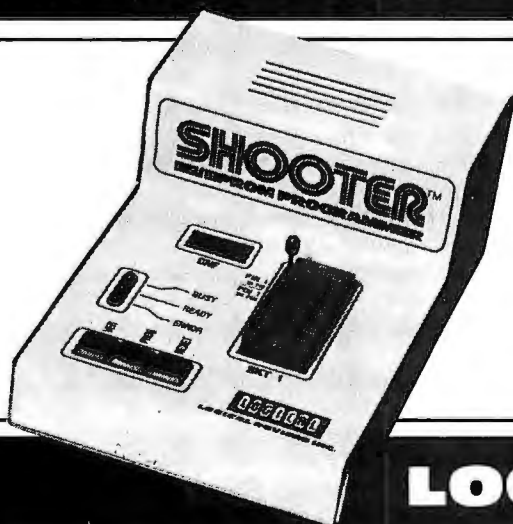
atari/tech.st #149, from wbaker [Bill Baker]

I have given up on Hippo C. Bugs, fairly slow, and almost no documentation. Just received an early copy of Megamax C. So far it looks very good.

Programs written for DRI C work perfectly. Compiles are fast. Comes with a graphical shell. (Although the linker will not work under the shell if you are using double-sided drives.) Am looking forward to the final release.

(continued)

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atari/tech.st #204, from dmenconi [Dave Menconi]

TITLE: Micro C Shell

For you UNIX fans out there, there is a relatively new product out called Micro C Shell. It is a C shell that sits on top of TOS and pretends it is UNIX. I have talked to the people at Beckemeyer, and it sounds like it is well worth the \$50 they want for it. It does pipes, script files, redirection, and aliasing and has about 25 of the standard UNIX commands as well as a partial library of C utilities.

The \$50 product doesn't do multitasking, but they are coming out with a multitasking add-on for extra money (\$100?—only approximate) that will.

If you are interested, you should contact

Beckemeyer Development Tools
592 Jean St., #304
Oakland, CA 94610
(415) 658-5318

atari/tech.st #170, from cheath:

I thought the Lattice Amiga compiler had problems, but now we're trying to port stuff from Amiga to Atari, and the Atari compiler generates pseudorandom structure addresses! We're having to convert all structure references into explicit offsets. This is an exercise in high productivity. (It's a good thing the Amiga isn't using this compiler; with all the wonderful Amiga data structures, it would take years to figure out what was wrong!)

atari/tech.st #171, from jsan:

a comment to 170

Metacomco have finished their Lattice C for the Atari ST, which is currently in beta testing at this very moment. If you want compatibility between your Amiga and Atari programs, then you could do worse than use the same C compiler—Lattice.

atari/tech.st #211, from jsan:

a comment to 206

I have used the Metacomco assembler. And it's very slow, but very good and full-featured.

I then went on to use the Kuma Seka assembler, on sale from Antic in the U.S. It's *very, very* fast at assembling but lacks most of the features of Metacomco's. However, it *does* have an integral Debugger and Environment (Shell!?) that makes it useful!

Assembly times of my program (back in the days when it was only 100K bytes of source code) were 30 minutes for DR assembler, 20 minutes for Metacomco assembler, and 6 seconds for Seka! Yes, 6 seconds! It accomplishes this because the file is loaded into RAM before assembly. All editing and other functions are done with the file intact. Also, Seka needs no stupid RELMOD program; its output is runnable immediately.

On a 512K-byte machine, it's unlikely you will manage to fill memory with your source file.

There is one further assembler out, which I consider the best of the lot! It's HISOFT's DEVPAI. Phone them in Dunstable, England; number (582) 696421.

It's as fast as Seka but has fewer disadvantages. First, it runs properly with GEM and has a *nice* decent editor. Next, it allows include files, so you are no longer limited by memory size.

There is also a GST assembler coming out, which, knowing their reputation, will *also* be pretty good.

atari/tech.st #151, from qpro [Christina Willrich and Richard Man]

In *Analog*, Tom Hudson did an article on the Mandelbrot set. His DRI C program produced a low-res picture in 20–45 minutes. My back-of-envelope calculation shows that an average picture takes 20–60 million floating-point operations. A friend has written a Mandelbrot program in Amiga BASIC that takes 3.5 hours to do a picture. Since this is a calculation-intensive program, the difference between interpreter and compiler should not be that great. Also, my friend is using the fast floating pointer in his Amiga. What gives?

atari/tech.st #152, from dmenconi:

a comment to 151

It is true that, once the interpreter figures out what the calculation is, the actual calculation will take roughly the same time whether the program is BASIC or C. However, the overhead involved in setting up for each calculation is not trivial. Also, there is the looping and the condition testing, not to mention storing and retrieving data. Given all this I am not much surprised at a 7 to 1 improvement of C over BASIC. In fact, I would expect more. Either the Amiga BASIC is very good or, as you suggest, the type of problem is slightly better suited to BASIC.

Since the two processors are the same and the machines are not doing graphics in real time (I assume), the difference in the two computers would be the language and the clock speeds (I think the ST is a smidge faster, isn't it?) and, of course, how the two programs are written. I would say that there are too many variables to use this as a comparison between the two machines.

atari/tech.st #154, from cheath:

a comment to 153

I'd expect the Atari to be about 5 percent faster if they use the same floating-point routines, on this nongraphic-intensive application. If there are moving images on the screen, the Amiga is 2 to 5 times faster, from our limited experience.

atari/tech.st #155, from skrenek:

a comment to 154

I was surprised that the Amiga came out faster than the ST on this timing. The pixel drawing to fill the screen should be such a small part as to be unimportant. I also would expect the ST to be faster on the pure math. There were some slight differences because of the way the libraries are accessed. In fact, now that I think about it, Tom may have said that the square root function is double precision on the ST.

atari/tech.st #156, from jsan:

a comment to 155

In some ways, even without hardware assistance, it is easier to draw a pixel on the Amiga than it is on the Atari. The Amiga has the most logical video bit-plane logic of all—pure contiguous memory.

The Atari utilizes interleaved bit planes, which, although useful on occasion, make it slightly slower when doing raw graphical functions, like line drawing or pixel plotting.

The Amiga clock speed is 7.2 MHz, whereas Atari's is 8.0 MHz. Having said that, Lattice C, the standard on the Amiga, may be producing tighter code.

A better benchmark would be using the Green Hills C that Amiga themselves use. I've been told that it produces real quality code, which runs much faster than Lattice or any of the others.

Incidentally, I would be interested in someone writing *exactly* the same program on both the Atari and Amiga machines—and even using the *same* compiler. This is now possible because Lattice C has

been written on the Atari ST by Metacomco. It's at the beta-testing stage but should be released shortly.

I think the bottom line is that anything involving *graphics* will be inevitably faster on the Amiga due to hardware graphics support and more logical screen memory, but that in raw processing, the Atari will be very slightly faster than the Amiga.

Having said that, in the *real world*, no program does raw processing without *some* screen interaction. All programs have text or graphics routines in abundance, which is, of course, where the Amiga excels. Real world is what counts, and so it's likely that most real-world application programs will apparently run faster on the Amiga.

TOS IN ROM

atari/non.tech.st #125, from dmenconi:
a comment to 124

I have heard (and would like to verify) that the users groups will get the ROMs (EPROMs, if you want to be picky) soon now with the understanding that they should copy them as needed.

atari/non.tech.st #127, from neilharris:
a comment to 125

Users groups who bought STs directly from Atari will get one set of ROMs (not EPROMs) per machine purchased, when available (probably January). I believe that we will allow people to copy them on EPROM for members. Otherwise, dealers can install the ROMs. The suggested price is \$25.

atari/non.tech.st #141, from jsan:
a comment to 139

Developers can send blank EPROMs to Atari Tech Support and have them returned with ROM TOS on them. If in England, they can contact Computer Concepts, who are Atari's agents for distribution of the EPROM TOS.

atari/tech.st #164, from jsan

I've just received my TOS on ROM (well, EPROM, actually). It's great, being able to power up and use the machine *instantly*! Especially useful for development of my game because every time it crashes I have to *reset*. At least now I don't wait 30 seconds each time.

One thing I noticed. Colour mode has its display shifted right by a large amount. It's almost off screen compared to TOS on disk. What can I do about that?

atari/tech.st #165, from jtittsler:
a comment to 164

On the back of your "colour" monitor there is an adjustment that will permit you to center the display to your liking. When TOS was put into ROMs for the European market, the decision was made to accommodate 50-Hz PAL displays, and so it will appear shifted on your monitor as it was set up. The monitor has plenty of lock range, however, so it should be easy for you to get it centered.

atari/tech.st #167, from jsan

TITLE: U.K. ROM TOS Patch for Early Machines

Jim Tittsler—Many thanks for the help you (and Shiraz) gave me just now on the phone. The solution was to modify the 50/60-Hz flag back to 60 Hz on boot-up. The following code performs that task, as I'm sure others will be interested in a patch, too. (Although quite how many Brits there are on BIX is not the issue, hehe!)

;Patch to fix UK ROM TOS from having shifted display!

```
;
;
;
;
;
;
```

(c)1985, Argonaut Software Ltd., UK.

By Jez San.

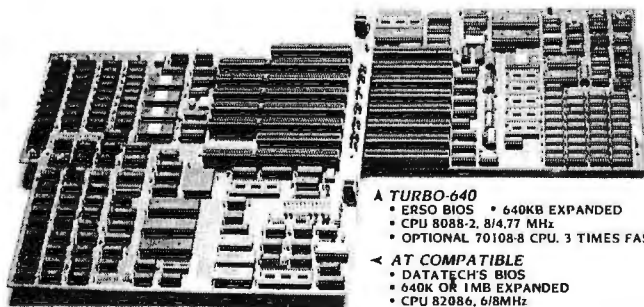
```
; Assemble this program, and save it as "FIXIT.PR" inside
; the "AUTO" folder on your drive 0 disk. When UK ROM TOS
; boots up, it will execute this program, which resets the
; 50/60-Hz flag back to 60 Hz, which puts the display back in
; the centre of the screen for us early ST users. People
; lucky enough to have the recent version of the Glue chip
; will not have this problem (so I'm told!).
;
```

```
move.l #stack,sp ; TOS doesn't allow us to use its own stack, snif!
clr.l -(sp) ; Set Supervisor mode (ho hum ...!)
move.w #$20, -(sp)
trap #1
addq.l #6,sp ; Reset the stack
move.b #$fc,$fff820a ; Change the flag back to 60 Hz
clr.w -(sp) ; Exit gracefully back to TOS/Desktop
trap #1 ; (Did I say Gracefully? Surely Not!)
; That's it, possibly the smallest program I have ever written!
; [Also, the first program I wrote that worked first time!]
dc.l 0,0,0,0,0,0,0 ; Call this a "Stack"?
stack:
end
```

(continued)



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VT52

atari/tech.st #185, from mofi [Ric Young]

Has anyone had a problem with the VT on the desktop? It seems to lock up for no apparent reason at all.

atari/tech.st #186, from jsan:
a comment to 185

The reason for the lockup is that the dumb ST will occasionally receive an XOFF character. This tells it to stop sending any more characters down the serial port, and hence until you receive an XON character, it will *lock up*!

The problem arises when the XOFF wasn't sent intentionally and was either sent via line noise or was in fact output by the ST but was inadvertently echoed back into the ST due to a Hayes-compatible modem that echoes its command line.

Quite simply, you're stuck!

I/O ON THE JOYSTICK PORT

atari/tech.st #212, from al [Alastair J. W. Mayer, author of BIX's CoSy software]

A question/assumption: Is the pin-out on the ST joystick port the same 9-pin pin-out as the original Atari joystick port (and the VIC-20 and C-64)?

If so, is whatever peripheral chip the port attaches to capable of both reading and writing the joystick button ports? (Obviously can't write the analog paddle ports.)

I have a Sequential Circuits plug-in music keyboard designed for the C-64. It plugs into the joystick port—it takes power from the 64 and is read by using two pins as output to clock out the key-press data in serial form through one input pin.

Can I program the ST to do the same? Or is the ST game port input-only?

atari/tech.st #216, from neilharris:
a comment to 212

It is the same pin-out as far as the digital signals are concerned. There are *no* analog inputs. Data from the joystick/mouse ports is fed into a 6301 single-chip processor, which sends data through a 6850 ACIA to the main system. More info is available in the Atari developer's kit or, at lower cost, in the book *Atari ST Internals* from Abacus Software, (6'16) 241-5510.

atari/tech.st #220, from jtittsler:
a comment to 212

(In addition to Neil's comments.) The ST joystick ports are the same pin-out as the older Atari 8-bit line, but they are input-only. They are sampled by the keyboard microcontroller, and packets of information concerning state change can be sent to the 68000 or the microcontroller can be interrogated about the current state depending upon what is appropriate for the application. There is also one special mode that repeatedly samples the "fire button" input of joystick 2 and packs 8 samples/byte for reporting to the 68K (this was included for a couple of potential applications that required an easy way to sample 1 bit).

atari/tech.st #225, from al:
a comment to 220

That was the impression I got from Neil's comment. The pins are read-only. Fine for joysticks and the like, but darn, I really *like* the ability to use those pins as outputs too. (On the C-64 they're wired to a 6526 in-

terface adapter, on a VIC-20 to a 6522 [you should know that, Neil!]; thus they can be set for I or O by setting the data direction register on the chip.) I've put together a couple of different gizmos that use that ability, and the Sequential Circuits keyboard is another one.

Are there *any* programmable output ports on the ST? (Other than, obviously, the predefined MIDI and RS-232C serial ports and disk ports.) If not, how about a 6522 cartridge for the "ROM" port? (Will that work?)

Or can the keyboard microcontroller be reprogrammed? (I suspect the answer to the latter is that it would be far more trouble than it was worth, if I have to burn a new ROM for it or something.)

atari/tech.st #227, from neilharris:
a comment to 225

You can't even make a new ROM for the keyboard controller, since it is part of the single-chip microprocessor. Why not use the parallel printer port, which happens to be bidirectional?

atari/tech.st #230, from jtittsler:
a comment to 225

Yes, as Neil suggests, the bidirectional parallel printer port would be a good candidate. There are also a couple of other parallel output bits available that might serve. One bit is available on the video output connector; we intend that to be used to switch from one monitor to another, but obviously you can use it for other purposes. Another bit is available on the output port of the sound chip that is not even brought out to any connector in the current machine, so you could use it by "blue-wiring" it to the place of your dreams (only with a little bit of peril, since future machines might take advantage of that bit). You could likewise get outputs by using the 6850 modem control lines if you don't mind hacking up your ST.

atari/tech.st #231, from neilharris:
a comment to 230

Keep in mind that these suggestions violate the protocol for keeping compatible with the future. If for one person's application for one machine, fine. Definitely not a good idea for anything commercial!

PRINTERS

atari/non.tech.st #179, from dmenconi

What sorts of printers go well with the ST? Is the Atari printer the best bet or are there better ones?

atari/non.tech.st #181, from neilharris:
a comment to 179

We recommend anything compatible with the Epson Graftrax protocol.

atari/non.tech.st #180, from mofi:
a comment to 179

Well, I use my Epson RX-80 F/T+ with my ST. I went out to Radio Shake (Shack) and got the standard cable and everything works just fine. FirstWord has the drivers for the Epsoms, so printing is simple. I prefer Epson for dot-matrix printing to Atari printers (talking from past experience only, not present new ST printers).

atari/non.tech.st #182, from skrenek:
a comment to 179

I think my Star SG-10 looks great with the ST. (For those of us still in the

Dark Age of black-and-white print, that is!) You may still have to make your own cable, though.

atari/non.tech.st #187, from jtittsler:
a comment to 179

The pin-out of the D connector on the back of the ST was designed so that a typical PC printer cable with a DB-25P on one end and a Centronics connector on the other end would work.

atari/non.tech.st #183, from dmenconi:
a comment to 182

Is there enough documentation to figure out how to make a cable?

atari/non.tech.st #184, from skrennek:
a comment to 183

Apparently there is enough info with the developer's package. I don't know what info comes with the consumer version regarding printer port pin connections. Any consumers out there?

atari/non.tech.st #188, from bwebster [Bruce Webster, Consulting Editor, BYTE]:
a comment to 184

The 520ST owner's manual has pin-outs for all the ports in the back; see page 76 for the printer port.

DISK FORMATS

atari/news.st #218, from jsan

We are using a disk format on the ST that gives us 409K of storage in an SF354 disk drive!

We did this by using 1K-byte sectors, instead of the ubiquitous 512-byte sectors that everyone else uses!

I don't see why Atari uses 512-byte sectors, because the cluster size is *two*, which makes DOS use 1K-byte blocks *anyway*, so you might as well have used sectors of 1K byte, and a cluster size of *one*!

The extra 50-odd K that we get using 1K-byte sectors makes it *very* worthwhile.

atari/news.st #219, from jtittsler:
a comment to 218

Yes, there are also some folks using 10 sectors per track instead of 9. We wanted 512-byte sectors for a variety of reasons, including compatibility with some future products. But as you have obviously found out, it is not difficult to support a variety of media formats.

ST WINDOWS

atari/non.tech.st #129, from dmenconi

Is it true that the ST does not let you arbitrarily position your icons?

atari/non.tech.st #130, from neilharris:
a comment to 129

You can put your icons where you like on the desktop, but not in the windows.

atari/non.tech.st #131, from dbetz [David Betz]:
a comment to 130

I think that it is really important to be able to arrange the icons in a disk window the way you want to. One of the things that makes the Macintosh so easy for new users to understand is that documents

seem to behave as real objects. When you move a document, it stays where you put it. You can arrange your documents in a convenient order on your desk (in windows) and they remain in place from session to session. If you take away that ability, you are left with something that is no different from a traditional file system with pictures as file extensions.

STAR RAIDERS

atari/non.tech.st #156, from tom__thompson [Tom Thompson, Technical Editor, BYTE]

Truth to the "Star Raiders II" rumor?

atari/non.tech.st #163, from neilharris:
a comment to 156

It is under development by one of our best in-house programmers. He has many of the early routines done, but it will probably be 3-4 months more work for him. Looks awesome—thanks to the ST's better resolution; the different displays from the 8-bit version are combined on one main screen. So the galactic map is displayed as a hex map in the lower part of the screen.

atari/non.tech.st #166, from tom__thompson:
a comment to 163

Thanks for the info, and keep us posted. Please don't cramp the big display too much—a lot of Star Raider's appeal came from getting involved in the big screen display. I'd like to see more sophisticated graphics (shouldn't be too hard with the ST, right?), particularly realism on the attack vessels, and more elaborate attack algorithms from the enemy ships.

atari/non.tech.st #175, from jerry [Jerry Pournelle, Consulting Editor, BYTE]

I want Star Raiders for the ST. I want Star Raiders for the ST. I want Star Raiders for the ST. I want . . .

IBM

This month's selection of activity in the IBM conference features a continuation of the discussion about the NEC V20/V30 CPUs, questions and answers on how extended memory and memory overlays work, more comments on methods to speed up the PC AT, and a suggestion on how to extend the environment space on a PC.

V20/V30 PERFORMANCE

ibm.pc.pc.hardware #370, from lconfer [Les Confer]

8088 Speedup

Does anyone know if it's possible to speed up the PC by swapping to an 8-MHz 8088 or V20 and timing crystal? How do the "turbo-compatibles" accomplish switching between 4.77 and 8 MHz? Is it possible to implement the same type of scheme in the PC?

ibm.pc.pc.hardware #372, from cjackson [Craig Jackson]:
a comment to 370

There's been some talk of this here and in the cpus/v20v30 conference. I don't think anybody here has actually done it. You can *buy* kits to perform this conversion; back of *PC Week* and back of *InfoWorld* have

(continued)

ADD-INS

Data Acquisition for Apple IIs

Xcalibur's XAD5 is a multifunction data-acquisition board for Apple II and compatible computers. The board includes 32 single-ended channels of 12-bit A/D conversion, either current loop or voltage input. The analog inputs may be configured for differential input with gain. XAD5 also provides 24 channels of digital I/O and a real-time clock/calendar with battery backup.

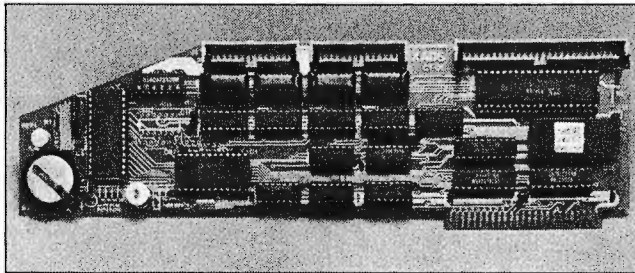
The board includes a feature called Autoscan, an interrupt-driven routine in ROM that automatically scans all channels and the real-time clock and then writes the values into the computer's RAM. Scanning is done at a rate of more than 100 channels per second.

XAD5 sells for \$549, which includes a demonstration disk and manual. For more information, contact Xcalibur Computers Ltd., Spencer House, 3 Spencer Parade, Northampton, NN1 5AB England, telephone: 011-44-604-21051. Inquiry 574.

STD Bus and IEEE-488 Interface

Computer Dynamics' CDI-488 board provides an interface from an STD bus to the IEEE-488 GPIB. The board is intended for laboratory automation and applications using equipment with IEEE-488 protocols.

The CDI-488 can be either polled or interrupt driven. Other features include software-readable GPIB address switches and eight GPIB status indicators. The maximum data-transfer rate is 1



Xcalibur's XAD5 data-acquisition board.

megabyte per second; 250K to 500K bytes per second is typical, according to the company.

The price for the CDI-488 is \$300. Contact Computer Dynamics Inc., 105 South Main St., Greer, SC 29651, (803) 877-7471. Inquiry 575.

More Memory for Ataris

Persistent RAM cartridges from Intra-Tech Computer Products are designed to expand the memory of Atari computers. Available in 16K- and 32K-byte versions, the cartridges use low-power RAM with backup power provided by a lithium cell.

Version I, the 16K-byte model, can be used in a 16K- or 8K-byte mode. Version II, the 32K-byte model, has two switch-selectable 16K-byte blocks. Each model has a switch that lets you change from read/write to read-only. Both can be used to make boot cartridges for most 15K-byte or smaller binary programs.

Version I costs \$49.95, and Version II is \$69.95. They run on the Atari 400, 800, 600XL, 800XL, 65XE, and 130XE computers with one disk drive. Contact Intra-Tech Computer Products, 2288

Portage Ave., Coquitlam, British Columbia V3K 2Z3, Canada, (604) 942-7049. Inquiry 576.

EPROM Writer for IBM PCs

The Addonics EPROM Writer is an add-in card for IBM PCs and compatible computers that lets you program a wide variety of EPROM, EEPROM, and single-chip microcomputers. The EPROM Writer provides normal and high-speed programming modes and performs byte programming, memory fill, block move, RAM editing, check sum, and other functions.

The board comes with software drivers for computers running MS-DOS or Concurrent CP/M. Slight modification of the drivers enables you to program newly developed EPROMs.

The EPROM Writer sells for \$450. For more information, contact Multitech Electronics Inc., 1008 Stewart Dr., Sunnyvale, CA 94086, (408) 773-8400. Inquiry 577.

MaynStream Tape Drive

The MaynStream PCi 20 from Maynard Electronics is an internal streaming-tape backup system for the IBM PC and compatibles. It can back up

a 10-megabyte drive file by file in 3 minutes and uses 1/4-inch data cassettes, which hold up to 20 megabytes of data each.

The MaynStream drive performs read-after-write checks to ensure the accuracy of backed-up data. It also has file-splitting capability, which lets you continue backup on a new cassette when the other is full.

The PCi 20 costs \$1299 and comes with a controller card or module, one 20-megabyte cassette, software, and a manual. Contact Maynard Electronics, 460 East Semoran Blvd., Casselberry, FL 32707, (305) 331-6402. Inquiry 578.

No-Wait-State Memory for the IBM PC AT

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help and simplify the language grammar, so that the compiler writer can concentrate on the important things, like effective optimized code generation.

Mr. Pickerill suggests that a CR-LF sequence is sufficient to terminate statements; he is showing his assembler roots. An important feature of modern languages is that they are lexically independent of the source-code format. That is, it doesn't matter how you indent your code or how you break it up across various lines, it still looks the same to the compiler. This is not true of BASIC or most assembly languages. While some languages force the programmer to indicate explicit line continuations, I abhor any dependency on the source-code format. Let's face it, how many people enjoy counting out to column 7 for their FORTRAN programs? How about all you COBOL programmers making sure that paragraph names begin in column 4 (or was it 8)? And let's not forget putting those FORTRAN continuation marks *exactly* in column 72!

In conclusion, I'd just like to say that Mr. Pickerill is entitled to his opinion. However, those who are interested should understand that most languages are not designed willy-nilly. A lot of thought goes into each and every trade-off made during the course of designing and implementing a language. A full understanding of those trade-offs is necessary before you start condemning a language.

As an aside, Mr. Pickerill concludes with the contention that assembly code still has a place in this world. I agree, when one is programming in a **uniprocessor** environment. Let me tell you, though, writing effective assembly code in a multiprocessor environment (with hundreds of processors) is so difficult that the only recourse is to use high-level languages that hide the scheduling problems from the programmer.

CHUCK MUSCIANO
Palm Bay, FL

ATARI 520ST VERSUS AMIGA

I am very glad that you did such a fantastic product description on the Atari 520ST (January, page 84). I have had mine since mid-November, and I think it's going to be around for quite some time. But there are a few things that I should mention concerning the ST and its future.

To start, I want to tell you a little about the ST-Amiga battle. For the moment, let's just imagine that the Mac was never created. Both machines are new, and both are quite good in their own right. But there is a large price difference, and what you

(continued)

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Inquiry 111

LETTERS

get for your money may not be what you paid for. The Amiga's graphics ICs are very powerful, and the sound chip gives good synthesized music, but that is where the power stops dead in its tracks. However, since people respond emotionally to sight and sound, the demos are sure to catch someone's eye. Inside, there is very little true support for the unbound power of the 68000. In the low-resolution mode, those great graphics chips steal almost 75 percent (yes!) of the possible CPU time that could be used for other real-computer things. Since the complicated data for the screen must come from the same RAM on the same bus as the CPU, there are excessive wait cycles imposed on the 68000. This, together with an overall slower CPU time than the ST, causes the Amiga to appear timid when compared to the ST.

Inside the ST, you will find more custom ICs than the Amiga and more powerful off-the-shelf chips than the Amiga. This adds up to a suprafast computer. Further into the hardware side of things, the ST has three serial ports (RS-232C, MIDI in, and MIDI out) and a keyboard. All of these are handled separately, without the 68000, and all in hardware. The 520ST also has a 68901 interrupt controller that keeps track of 16 separate events in the system with very little intervention by the CPU (this chip is really a necessity with the 68000 and is missing from the Amiga). And this (drum roll, please) is where the DMA port comes in. It transfers data to RAM without using the CPU, and does it at a rate of 1.33 megabytes per second. The standard disk drives are also quite fast. The ST can bring in a 32K-byte file—including start-up, directory search, and loading—in less than 4 seconds. The Amiga takes almost 20 seconds. The Amiga also uses an awkward disk configuration, and much of the disk support is done in software (*slow*). The drives can store slightly more than the ST's double-sided drives, but time is sacrificed in exchange. The Amiga format is done much like a C-64. In fact, to get a directory, the Amiga goes out and finds a program called DIR, loads it, and then goes back searching—not a very speedy or effective way of doing things.

Now to talk about software. First of all, there is almost four times as much software out for the 520ST as for the Amiga. Second, Intuition on the Amiga is graphically more colorful than GEM on the 520ST but really isn't a good user interface. The windows are poorly configured and move with flicker. The Amiga operating system is very clumsy to use and full of bugs. And for the note of how every-

(continued)

body compares them and rates them against the Mac, you must consider that Apple is not letting any operating systems look or act like theirs.

If you have a problem with your Amiga that your dealer doesn't know about, you are pretty much stuck. To talk to Commodore you either have to be God or Electronic Arts, a company that mainly focuses on games. If you want to talk to people at Atari, they are very free, open, and extremely nice.

The last thing I want to mention is that on page 99 of the article on the 520ST, the authors state that the only way to move a file out of a folder is to copy it to another disk and then copy it back to the original disk outside of the folder. There is a much simpler way of doing things. First, open the directory for disk A. Then double-click on the folder you want. It should open up and show you the file you want to copy. Then go back and double-click on the disk A icon again. It

will open up into another window, so that now you have the main directory and the folder directory. Simply drag the file you want copied from the folder's directory into the regular directory window, and it will copy out of the folder. True, you do have to go back and delete the original file, but this is really a quite sane precautionary procedure. Suppose you then decide you didn't want it moved, or maybe it gets lost, or the disk crashes. You still have the original.

MIKE M. FARNSWORTH
Renton, WA

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How Good Is DVORAK?

The February BYTE contained an article on page 241 concerning the Dvorak keyboard arrangement ("Keyboard Efficiency"). Having used the Dvorak keyboard for many years, I eagerly read what Donald W. Olson and Laurie E. Jasinski had to say about it.

However, their results correspond neither with the many books and articles I have read on the subject nor with my own experience. I downloaded the BASIC program, but, not being a programmer, I couldn't figure out what was going on. So I tackled the problem with a pencil and paper.

My approach was more intuitive than scientific, I guess, but it seemed that if the Dvorak arrangement had all but 2 of the 12 most-used letters in the English language (ETOAINSHDRLLJ, as I have read) on the home row, then it must be more efficient than the QWERTY arrangement.

To simplify my task, I used units instead of actual measurements and set to zero all operations that both arrangements share. That is, the space bar, the shift key, and the actual key travel were all disregarded. Next, I assigned all home-row keys that lie under the typist's fingers a value of 0. All home-row keys that don't lie under the typist's fingers received a value of 1. Upper- and lower-row keys received a value of 2, with the exception of the keys the typist must stretch for. These received values of 3. For the QWERTY arrangement, the hyphen also was assigned a value of 3.

I used Lincoln's "Gettysburg Address" for my work text. After saving it to disk, I used the search-and-replace feature of Spellbinder to do a simple number-for-letter substitution both for the QWERTY arrangement and for the Dvorak arrangement. I added the resulting string of numbers on an adding machine.

Viewing the final printout, one immediately sees that virtually no word of any significant length can be typed with-

(continued)

Compaq Announces 80286-based Portable

Compaq Computer Corp. has introduced the Compaq Portable II, an IBM PC AT-compatible computer based on an Intel 80286 processor running at 6 or 8 MHz. Lighter and smaller than the original Compaq Portable, the new computer weighs 23.6 pounds and measures 7.5 by 13.9 by 17.7 inches. It has a modified IBM PC AT keyboard, a 9-inch monochrome monitor, a real-time clock, a socket for an 80287 coprocessor, parallel and serial interfaces, and interfaces for an RGB or composite monitor or standard TV set. The dual-mode monitor displays 80 characters by 25 lines and has a resolution of 640 by 200 pixels in graphics mode and 720 by 350 pixels in text mode.

The machine has room for up to two storage devices, either two 1/3-height 360K-byte floppy-disk drives or one floppy drive and a 1/2-height 10-megabyte hard-disk drive. Like the hard disk in the company's first portable, the new portable's hard-disk drive is shock-mounted, but it now includes a disk-controller board, eliminating the need for an expansion board.

One of the computer's expansion slots is 8-bit, and the other is 8/16-bit. The main system board can hold 640K bytes of RAM. An optional memory board that attaches under the main system board enables you to



The Compaq Portable II runs on an 80286 processor.

expand memory to 2.1 megabytes without using an expansion slot. All configurations can hold up to 4.1 megabytes of RAM.

The new machine's 165-watt power supply, which is more powerful than that of the original portable, uses surface-mount technology to achieve greater power in a smaller unit. As an \$89 option, the Compaq Portable II features an automatic power-switching board that senses whether you have 110- or 220-volt operation and adjusts the machine to handle the correct voltage.

The Compaq Portable II sells for \$3499 with 256K bytes of RAM and one 360K-byte floppy drive; \$3599 with 256K bytes of RAM and two floppy drives; and \$4799 with 640K bytes of RAM, one floppy drive, and one 10-megabyte hard disk. Contact Compaq Computer Corp., 20555 FM 149, Houston, TX 77070, (713) 370-0670.

Inquiry 550.

Atari ST Hard Disks

The SupraDrive Hard Disk series for the Atari 520ST and 1040ST computers is available with 10, 20, 30, or 60 megabytes of storage. The drives attach to the computer's high-speed DMA port and, according to the company, improve the speed of data transfer by three to ten times over that of floppy-disk-based systems. The company says the burst data-transfer rate is 155K bytes per second for the 10-megabyte drive, 625K bytes per second for the 20-megabyte drive, and 940K bytes per second for the 30- and 60-megabyte drives.

The 520ST and 1040ST can boot directly from the SupraDrives. All the drives come with software that includes formatting, partitioning, and backup utilities. Partitioning lets you create up

to four logical drives for file storage, each of which appears as an icon on the GEM desktop and can be used like a separate disk drive.

The drives are compatible with the TOS operating system and applications software and with other DMA-bus peripherals for the 520ST and 1040ST, such as CD-ROM players, coprocessors, and other devices. Prices are \$799 for a 10-megabyte drive; \$995 for 20 megabytes, \$1295 for 30 megabytes, and \$1995 for 60 megabytes. Contact Supra Corp., 1133 Commercial Way, Albany, OR 97321, (503) 967-9075. **Inquiry 551.**

Borland's Prolog

Borland International released Turbo Prolog, designed as a software simulation of the Japanese fifth-generation computing engine. The compiler runs on any IBM PC with at least 384K bytes of RAM and one disk drive.

Turbo Prolog is an incremental, six-pass compiler that produces native-code, linkable object modules; its linking format is compatible with the PC-DOS linker. The programming interface, which employs its own pull-down menus and windows, lets you move back and forth between windows for purposes of editing, debugging, listing, and running a program. Type checking can be done across module boundaries. Borland says there are no limits to the

(continued)

BYTE'S BUGS

Repairs to Robotics Articles

In editing "Autonomous Robot Navigation" by Charles Jorgensen, William Hamel, and Charles Weisbin (January BYTE, page 223), we inadvertently added a few errors and omitted a reference. These corrections relate to the text box "Sonar Sensors" on pages 230-231.

First, figure A4 represents an answer to the problem of sonar's low angular resolution rather than representing the problem itself. The figure shows the sonar analog of binocular vision.

Second, in the actual distance formula in table A, the D_r and the equal sign are

reversed. The proper formula is

$$\text{Actual Distance} = D_r \sqrt{A_r / S_r}$$

Third, figure A, table A, and the associated text are drawn from H. R. Everett's article "A Multielement Ultrasonic Ranging Array," which appeared in the July 1985 *Robotics Age* (page 13). Mr. Everett's article was cited in the references at the end of "Autonomous Robot Navigation," but the citation of the reference was not included in the article itself.

A slight typo appears in listing 1 of "AI in Computer Vision" by John L. Cuadrado

and Clara Y. Cuadrado (beginning on page 237). On page 245, in the line preceding the comment that PDPROLOG does not support floating-point math, cylinder should have an uppercase C.

And finally, in Kirk E. Pennywitt's "Robotic Tactile Sensing" (beginning on page 177), the definition on page 200 of a newton is slightly flawed. As Keith J. Lavallee of East Hampton, Connecticut, pointed out to us, the correct definition is: 1 newton equals 1 kilogram meter/second squared.

Our apologies to readers and writers.

More on "Arithmetic"

Surry P. Everett, a reader in Bath, North Carolina, encountered a few problems while working with Peter Rice's "Arithmetic on Your PC" (March 1985, page 119). He points out that dividing a number by itself (25/25) results in an error (illegal function call) at line 11070 of listing 1 because N, used as a subscript, is less than zero. Mr. Everett suggests the following code change, which Mr. Rice agrees works:

```
11070 WHILE Z%(N)=0:IF N=0
      THEN GOTO 11080 ELSE
      N=N-1:WEND
```

Two similar errors appear at lines 13370 and 13630 if a single-digit divisor (25/5) is used. Mr. Everett suggests the following:

```
—Add a line: 13365 IF Y%(100)=0
                THEN GOTO 13400
—Delete line 13640
—Change a line: 13650 IF BX=0
                  THEN GOTO
                  13670 ELSE
                  BX=BX-1
```

According to reader Everett, these changes will work in all situations of non-negative integers, excluding a divisor of zero.

Mr. Rice says the only other problem he is aware of is in the assembler listing. People who downloaded LONGMATH.ASM can fix it by replacing JLE LABEL3 with JBE LABEL3 in the division procedure.

Four Little Steps Move 520ST Files

Our product description of Atari's 520ST (January, page 84) made the process of moving a file out of a folder, explained on page 99, sound more complicated than it really is. To move a file, open the folder

(which indeed takes over the disk window). Open the same disk again (which gives you an additional window of the disk). Copy the file from the folder to the disk window. Delete the file in the folder. Ta da.

SIMPL Name Already Claimed

Jonathan Amsterdam's three-part Programming Project that began in the December 1985 issue concerned a compiler that he named SIMPL. We've since received a letter from James E. Bernstein advising us that SIMPL is the copyrighted name of a high-level language and compiler developed and used by his company, General Health (in Washington, D.C.).

Mr. Amsterdam replies that he did a cur-

sory search of computer science literature before adopting the name. Some people at the University of Maryland had used it, but they did not object to him doing likewise. "My high-level language was constructed for purely pedagogical purposes," he writes. "It will probably never be mentioned again in print after the last installment of the project, and it certainly will not evolve into a product."

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port 2400-bps transmissions.

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BYTE listings are also available on BIX. After connecting with the system, type join listings at the main prompt. (For more information on BIX, phone (800) 227-2983 between 8:30 a.m. and 11:00 p.m. Eastern time, weekdays.)

lishers. I don't suppose AmigaDOS is that much more complicated than PC-DOS, but frankly I don't know. Like St. Augustine praying for chastity, I want to understand AmigaDOS, but "Not just Yet." I doubt that I'll be alone in that attitude.

Amiga lovers will counter that the average user won't need to understand CLI because the icon-operated part of AmigaDOS is as good as the

Macintosh operating system; and, after all, you can, with determination, learn CLI if you want to. Of course they're right. I suppose, too, that soon enough there will be books explaining AmigaDOS, just as there's a plethora of such books on CP/M and PC-DOS. Certainly the authors of such works won't lack for information. The Amiga Developer's Support package consists of six large volumes, each

densely packed with **information**, source code, examples, diagrams, and concise English. (The key word in that sentence is "densely.")

LATTICE C

I am no expert on C compilers. Fortunately, I know people who are. Most seem agreed: Lattice is the C compiler to use for Amiga product development. I am told that the Aztec C compiler is a bit faster and generates faster-running code. That, however, is more than made up for by the Lattice development tools, which include: a screen editor; a Make utility descended from the UNIX make; Lattice MacLibrary, which gives Amiga programmers many Macintosh features like drawing figures, generating scroll bars, creating music, and so forth; and a text-management utility that brings you grep and diff and a bunch of other UNIX tools C hackers are fond of.

I've met many of the people at Lattice, and I've always been favorably impressed. The Lattice system is available now for the Amiga (and, of course, for PCompatibles and most other computers) and is supposed to be available for the Atari 520ST by the time you read this. (I'd say Real Soon Now, but I have some faith in Derek Budge and the Metacomco people who are porting Lattice to the Atari.)

There is a Lattice conference on BIX; you can join that to learn far more than I ever want to know about the subject. C just isn't my language. It sure is popular, though.

ATARI 520ST

Meanwhile, the software for the Atari 520ST continues to accumulate. I've got Typesetter ST from XLENT Diskette Products Inc. (630 International Parkway, Richardson, TX 75081), which is a utility program that does layout and design stuff on the Atari for printing on Prowriter, NEC, and Epson printers; DEGAS, from Batteries Included, a color-paint program easily as nice as MacPaint (and which Typesetter ST can interface with); and a whole bunch of stuff from Hippopotamus Software.

There's also Regent Word I from

(continued)

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Regent Software. This is a full-screen word processor more than a little reminiscent of Electric Pencil. I used Pencil for years, and Larry Niven and I wrote several novels, including *Lucifer's Hammer* and *Oath of Fealty* with it. Regent Word I has most of Pencil's commands and, like Pencil (and WRITE, and all the word-processing programs I like), automatically reformats paragraphs when you insert or delete. It has help files, it's fast, and, although there is a little stuff on the screen I didn't put there—there's a continuous count of the amount of memory you have left—it isn't distracting.

The type is large enough on the Atari color monitor that I can sit at a reasonable distance with the monitor at eye level. I don't have to look through the bottom of my glasses.

There's one problem with Regent Word I. The type font is one of the ugliest I have ever seen. The lowercase "n" is taller than the "t." The body of the "i" is well below the level of the other characters, with the dot at the level of the top of the "n" or "s"; and so forth. The only thing I recall that was uglier was the type font used in the original Kaypro II computers. I *know* the Atari 520ST is capable of much nicer letters than that; why Regent didn't design a more pleasing type font is beyond me.

On the other hand, if I had to choose between writing a book with the Atari 520ST and Regent Word I or the Macintosh and MacWrite, I'd take the Atari every time. I can *see* type on the Atari.

There's a lot more stuff for the Atari. Michtron has sent me nearly a dozen programs, ranging from a RAM disk and a bunch of disk utilities (quite nice) to Mudpies, one of the dumbest arcade games I've ever seen. At COMDEX the Michtron people were demonstrating Time Bandits, a game based loosely on the movie, which had really lovely graphics. From what I could see watching over the designer's shoulder, I'll probably like it. Apparently they haven't finished that one yet, so they sent Mudpies, which has only reasonable graphics. The premise is that a little boy is throwing mudpies at a bunch of circus

clowns, who in turn are trying to clobber him with juggling clubs. It managed to hold my interest for nearly three minutes.

SUNDOG

The Atari is a natural for games, and I have no doubt there'll be a flood of them. I expect to have a new-and-improved version of Star Raiders for the 520ST about the time you read this, and I already have Hippo's Backgammon.

There's also Sundog from FTL Games/Software Heaven (POB 112489, San Diego, CA 92111). The original version of this was written by BYTE's own Bruce Webster for the Apple II. Sundog is played entirely with the mouse, but it is really a game of strategy; there are very few games like it. Parts of it resemble the Infocom strategy games, yet there are arcade-like features as well.

A story goes with it: a naive young chap—the story makes him male, but I suppose it wouldn't be hard for a female player to identify with the character—inherits a cargo spaceship, some bank accounts, and a contract to deliver a lot of stuff to a newly forming colony. The ship is in terrible shape. The new owner has never piloted a ship before and knows nothing of the interstellar trading business. Yet there certainly isn't enough money to repair and fuel the ship, eat, and fulfill the contract. This is on-the-job training with a vengeance.

The rule book tells you this and shows you some of the mechanics of operating the game; the rest is up to you. This is perfectly in keeping with the scenario. You're supposed to experiment to find out more. You can use the mouse to move your character out of the spaceship and into town, where you can go into stores for spare parts; bars for food, beer, and information; the goods exchange; and other places. So far, so good.

Unfortunately, Sundog was ported over from the Apple II with very little change, and that creates a problem. It was a real accomplishment to put Sundog on the Apple. Each time you enter a new kind of building or move the ship to a different area, an overlay

program is read in from disk. That disk was *full*. Bruce tells me that in some of the action scenes he was struggling to save bytes—not kilobytes, but bytes—to make it work. Sundog on the Apple II was so impressive in comparison to anything remotely like it that you were ready to forgive it a very great deal.

That's not true on the Atari 520ST. For example: the only way to tell what's in a building is to go inside. Some buildings can't be entered, but you don't know that until **you** try. Other buildings are extremely important, but you don't know what **they** are until you enter them; there are no signs outside. Once inside, you can interact with the characters you meet, but you must wait for information to be volunteered (if it ever is); you can't ask for it because there is no way to say anything that isn't offered on dialogue menus that pop up from time to time. The story line in the rule book leads you to think you'll learn about trade goods in bars; but all I ever got was people offering to sell me what appeared to be narcotics.

The only thing to eat, even on interstellar trips, is burgers, which can only be bought one at a time in bars. (You can buy beer, but you'll be much better off not to; Sundog seems to have been programmed by members of the WCTU.) The game doesn't tell you this; I spent a couple of hours looking for a grocery store, or ship's chandlery, or any place that would sell me a sack of potatoes or vitamin pills; but no, burgers are all you get. . .

Meanwhile, the cities have the strangest police I ever heard of. If you park illegally, you will instantly be ticketed and fined (your vehicle is locked up until you pay), but if you walk about the town, you are certain to get mugged. You can try to shoot your way out of mugging situations. This is where the arcade aspects of the game come in. If you survive, there's not only no necessity to call the police, there's no possibility of it, nor can you aid the wounded muggers; you simply leave them lay.

All this is trivially irritating; but what will drive you crazy is that although you are supposed to have a starship,

(continued)

you do not have available to you a computer as powerful as the one on which you're playing the game. That is: when you travel to foreign cities and enter the exchange, you see a bunch of price quotes. This is vital information; but the only way to preserve it is to write it down with pencil and paper. (Or drag another computer over and record on it! I swear I was tempted to set up a

SuperCalc spreadsheet on Big Kat and record the Sundog information on that, until sanity prevailed.) I can understand the necessity for a physical visit to a city to find out its prices, but I would imagine that any computer capable of interstellar navigation would be able to remember prices I have already seen and where I saw them.

Sundog is potentially as interesting

as any game I ever played; but I kept running into gotchas, and eventually I put it away. The graphics are great, and the idea behind the game is terrific. I just wish they'd rewrite it to take advantage of the Atari 520ST's speed and power. Faults I can overlook in Apple II games are glaringly obvious on the Atari.

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HOW BORLAND DOES SO MUCH, SO WELL, SO FAST

We asked Borland International president Philippe Kahn to share his secrets for rapidly taking a good idea and turning it into rock-solid reality. How does the Borland team do so much, so well, so fast?

He begins, "I remember when Atron used the June 24, 1985 *Wall Street Journal* chart of top-selling software in an ad." [Note: At that time, seven of the top ten software packages were created by Atron customers; it's now now nine out of ten.] "SideKick was number four, and I let Atron quote me in saying that there wouldn't have been a SideKick without Atron's hardware-assisted debuggers.

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"Cleverly written code is, by definition tight, recursive, and terribly complex," he continues. "Without the ability to externally track the execution of this code, competent debugging becomes very nearly impossible."

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A WHOLE BUNCH OF STUFF

This is getting to be a regular feature. We *always* get more stuff than we can write about, and much of it is pretty nifty. I've covered my desk with deserving software; now to try to work through as much as possible.

FACT CRUNCHER

Persistence pays. For more than a year I've been getting copies of a program called Fact Cruncher, which I assumed to be a database. It always got put in the "yet another" stack. Meanwhile, Infostructures (POB 32617, Tucson, AZ 85751) kept sending more copies, until the pile threatened to fall over. "All right," I thought. "I'll look at it."

I'm glad I did. In the first place, Fact Cruncher isn't a database at all. It's a dual-window outline processor with a pretty good built-in text editor. It has features you won't find in ThinkTank, isn't copy-protected, is slightly less than \$100, and comes with a really neat set of demonstration programs and tutorials. It does charts and other hierarchical symbolic representations as well as more conventional outlines with the ability to hide or display details. The multiwindow feature is very nice, there's a good help utility, and the whole thing is remarkably easy to use.

Fact Cruncher has gone onto Big Kat's hard disk and may well become one of the regulars here, in which case you'll hear more about it. Meanwhile, write them for a \$9.95 (refundable) demo disk.

FORMULA/ONE

This is another program I've neglected, largely because I haven't had a recent need for heavy-duty number crunching. Formula/One from Alloy Computer Products is a darned good math program that will handle most

(continued)



68000 WARS: ROUND 2

BY BRUCE WEBSTER

A continuation of Bruce's comparison of the prominent 68000 machines

Well, well, well. It's now late January, and the 68000 wars have heated up, with new products introduced, new markets opened, and the usual hyperbole from all parties. I've been doing a bit of 68000-oriented traveling: to the Consumer Electronics Show, to look at what's new from Atari; to Commodore and Electronic Arts, to see what they're cooking up; and to the AppleWorld Conference and the Mac/Apple II Expo, to gaze at the latest and greatest there. My spare time has been spent coding benchmarks for the ST machines, the Amiga, and the Macintosh machines—no mean feat, considering the mix of compilers, operating systems, and ROM routines I've had to sort out. Mixed in there somewhere is a two-week bout with the flu. All in all, a busy month.

THE ATARI 1040ST

In my February and March columns, I said a number of nice things about the Atari 520ST—and a fair number of not-so-nice things as well, mostly dealing with limited expansion, piles of cables, and ugly black power supplies. Well, now I have to eat some of my words. Atari took some major steps toward perfecting the ST with the release of the 1040ST, which is the 520ST "done right." The 1040ST has 1 megabyte of RAM, a built-in double-sided 3½-inch disk drive (709K bytes of usable space after formatting), an internal power supply, 128K bytes of ROM containing TOS and GEM, composite and RF video outputs (in addition to the regular Atari monochrome/RGB output), and—shades of Amiga—hooks for hardware graphics support via an add-on board. Atari improved an already-impressive price/performance ratio by offering the 1040ST with a monochrome monitor for only \$995. Combine that with Atari's hard disk (\$699), and you have a \$1700 personal workstation—68000 processor, 1 megabyte of RAM, 20-megabyte disk—that rivals systems costing up to 10 times that much just a few years (or months) ago.

Does the 1040ST have any bad points? Well, there's still no easy (within warranty) expansion path for adding RAM or other peripherals that don't use the serial, parallel, or DMA ports. Also, the 1040ST has the same large, awkward layout as the 520ST, though the reduced number of cables (due to the enclosed power supply and disk drive) helps. However, considering what you get for the price, these

seem like quibbles.

At this point, I must state that I have yet to get my hands on a 1040ST. However, BYTE's Peterborough office has had one for about a month now, so the machine is definitely real. In fact, since the 1040ST was on the cover of the March BYTE, it had better be real, or there's go-

ing to be a lot of red faces on both coasts. As soon as I can get one to work on, I'll give a full report.

THE NEW 520ST

What then has become of the 520ST? Simple: Atari has added RF and composite video output, put TOS/GEM in ROM (finally), unbundled it from the disk drive and monitor, and pushed it onto the mass market. For \$399, you can buy a 512K-byte 68000-based system, take it home, hook it up to your TV, and do absolutely nothing with it, since (as of this writing) there is no ROM cartridge software available. If you spend another \$199 for a single-sided disk drive—or, better yet, \$299 for a double-sided drive—you can do a whole lot with it. However, since you've now paid about \$700 for a 512K-byte system, double-sided drive, and no monitor, you probably would have been better off spending \$300 more for a 1040ST.

Software developers seem to be mostly happy with Atari's move, since it almost certainly means a larger installed base of 520STs. However, the computer-store dealers who were carrying the 520ST—and who are now carrying the 1040ST—seem to be less thrilled with the marketing shift. Many are not convinced that the public will see that the 1040ST is a better deal and believe that their would-be customers will go to K-Mart for a 520ST. Many, in fact, are downright upset about the whole thing. The irony is that a lot of these same dealers went through a similar situation when Commodore moved the C-64 onto the mass market—and the same man, Jack Tramiel, was behind both moves.

THE MACINTOSH PLUS

In a move that strongly parallels Atari's, Apple has released a new version of the Macintosh that fixes many (if not all) of the problems with the old Mac. The Macin-

(continued)

Bruce Webster is a consulting editor for BYTE. He can be contacted c/o BYTE, POB 1910, Orem, UT 84057, or on BIX as bwebster.

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tosh Plus looks much like the old Mac but has the following: 1 megabyte of RAM, expandable to 4 megabytes using the new 1-megabit RAM chips; 128K bytes of ROM (up from 64K bytes), with many of the routines rewritten for faster performance; an SCSI port that allows faster, cheaper hard disks (and other peripherals) to be hooked up; an internal 800K-byte disk drive; an expanded keyboard with cursor keys and numeric keypad; and, because of the space taken up by the SCSI port, modified printer and modem ports that now use a round 9-pin connector instead of the more common DB-9 connector on the old Mac.

Unlike the 1040ST, the Mac Plus offers a definite performance increase over its predecessor in both graphics and disk I/O. There's no parallel in price, either: The Mac Plus lists at \$2599, or more than 2½ times the cost of the 1040ST. In fact, for what you'd pay for a Mac Plus with an external 800K-byte drive (\$499), you could buy two 1040STs, each with a monochrome monitor and external 709K-byte drive (\$1298 per system), and an Atari RGB monitor (\$399) to share between them—and still have money left over.

Why does Apple charge so much for the Mac Plus? I can think of a number of reasons. First, Apple has a heavy R&D investment (a company total of \$263 million over the last five years) that it would like to recoup. True, not all of that was for the Mac, but the lion's share went into the Lisa/Mac/Mac Plus technology. Second, Apple is slowly penetrating into the corporate market, where the price differential just isn't an issue; you'll see few 1040STs sitting on executives' desks, but the Mac and Mac Plus look quite nice there. Third, the user interface, operating system, and ROM software on the Mac are (in my humble opinion) far superior to those found on the STs (or the Amiga or, for that matter, the IBM PC). That superiority is due in part to the large amount of time and money Apple has invested in it. Fourth, you'll find a large base of well-written, professional, innovative application software for the Mac. You can run programs like Helix, Microsoft Word, Filevision, and Excel on a Mac or Mac Plus; nothing remotely approaching those programs is available on the ST, and I wonder if parallel applications of similar quality and power ever will be.

In short, Apple is charging a premium price for the Mac Plus because it can get away with it... for now. That doesn't mean I agree with the price—I'd like to see it list for less than \$2000—but I do understand it.

The 512K-byte Mac is still on the market, though its official list price has dropped \$500 (to \$1999). Since the street price has been less than \$1900 for some time now, this could drop its price to less than \$1500, where—because of its software advantage—it could cause problems for the Amiga. Also, Apple is offering an upgrade path to turn a 512K-byte Mac into a Mac Plus. You can swap in an 800K-byte drive and the new ROMs for \$299, put in a 1-megabyte motherboard with the SCSI port for \$599 (\$799 if you have a 128K-byte Mac or a third-party memory upgrade), and get the new keyboard for \$129.

(continued)

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Be aware that the motherboard upgrade requires the disk/ROM upgrade. Also, Lisa/Mac XL owners can "up-grade" to the Mac Plus by trading in their old machines plus \$1500 for a Mac Plus with an Apple Hard Disk 20.

Where's all this leading? My best guess is this: If the 512K-byte Mac is still around by Christmas, it will be selling for around \$1000, trading punches directly with the 1040ST and the Amiga; the Mac Plus will be down to \$1900; and the Mac with slots (if it's out) will be selling for around \$3000.

THE OLD AMIGA

The news from Commodore continues to be mixed. Christmas sales (fourth quarter 1985) were \$340 million, based largely on strong sales of the C-64 and C-128. Commodore was claiming that it would post a profit for the quarter but appears to be backing down from that now. Even so, the sales are probably sufficient to keep the bankers from shutting things down. If Commodore is still alive by the time you read this, it will probably survive the year (and longer).

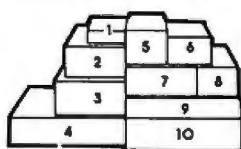
Finding out how many units have shipped of a particular computer is notoriously difficult, and the Amiga is no exception. The best information I've come up with indicates that about 50,000 Amigas were sold during the fourth quarter of 1985, matching reported U.S. sales of the 520ST for the third and fourth quarters of 1985 combined. (Atari claims another 50,000 STs were sold outside the U.S.) That would mean—in the U.S.—the Amiga outsold the 520ST during the Christmas season. That blows the prediction in my January column that the 520ST would outsell the Amiga at Christmas. Incidentally, Apple sales for that same quarter were slightly more than \$500 million, which represents about a 25 percent drop over Christmas 1984. However, because of the layoffs and streamlining that Apple did during 1985, profits were up by about 25 percent. This, of course, puts a sizable dent in my pick of Apple as "the big loser" for Christmas 1985. So much for my prognostications.

The sales figures for the Amiga are good but not great. One problem appears to be production; Commodore is literally selling Amigas as fast as it can make them, but that isn't very fast. Commodore is also having problems with marketing: Its people can't seem to make up their minds what market or markets the Amiga is aimed at. Their expensive ad campaign last fall was poorly conceived and poorly executed. I went past their first magazine ad three times before I happened to notice it was for the Amiga, and their TV ads (most of which I missed) were generally greeted with yawns and/or confusion. (Some of the techies at Commodore would like to run their own ad campaign, modeled after the Bartles & Jaymes wine cooler commercials: "We've been working on this computer for three years, and we'd really appreciate it if you bought one.")

Commodore's biggest mistake, in my opinion, was not having a booth at COMDEX and/or CES. At COMDEX, I asked Clive Smith (vice president of marketing at Commodore) about that decision; his response was that they

(continued)

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didn't want to attract any more dealers (or end users) because demand was already outstripping production. It was hard to swallow that answer then, and the past few months haven't made it any easier. Commodore's absence—combined with Atari's large, crowded booths at both shows—has made dealers, developers, and end users uncertain about the life expectancy of the Amiga. It hasn't done much for the confidence of the original designers and developers at Commodore, either. Recent months have seen the departure of Carl Sassernrath (author of Exec, the multitasking Kernel at the heart of the Amiga), R. J. Mical (author of Intuition, the high-level graphics library), and others. And some of those still at Commodore are less than thrilled with the confusion at Commodore HQ in West Chester, Pennsylvania. At this point, the single greatest obstacle facing the Amiga may be Commodore itself.

Lack of software for the Amiga is becoming less of a problem, though some critical applications—like a good word processor—have yet to appear. (Ever wonder how the Macintosh would have done if MacPaint and MacWrite hadn't been available when the machine was first shipped? Those two programs carried the Mac for several months, until other serious applications appeared.) And there appears to be plenty of demand out there: Trip Hawkins, head honcho at Electronic Arts, says that EA shipped more than a million dollars' worth of Amiga software in December alone, with Deluxe Paint being the biggest seller. While EA games will undoubtedly do well, the next blockbuster will probably be Deluxe Video, an impressive package that lets you use animation, special video and audio effects, and musical sound tracks (from Deluxe Music Construction Set, also coming from EA) to create your own video sequences. Since you can plug your Amiga into your VCR, said videos can be recorded for posterity (or customers or students or . . .). If you combine Deluxe Video with the yet-to-be-released genlock device that lets you use an external video source (VCR, laser disk, TV set, camera) as the background "color" on your display, the possibilities multiply. Could be lots of fun.

Another problem facing the Amiga right now is that third-party hardware companies have been slow in coming out with peripherals. Tecmar, which ballyhooed its line of Amiga add-ons at the time of the Amiga's introduction last summer, has—as far as I can tell—yet to ship any sellable products (some dealers have apparently gotten units marked "NOT FOR RESALE"). Tecmar also enraged a lot of Amiga owners by increasing its previously announced prices by about 50 percent; for example, the 20-megabyte hard-disk drive went from \$995 to \$1495. Tacky. . . and dumb marketing, to boot. I suspect that the first company to come out with nothing more complex than a RAM expansion box (remember, the Amiga can go up to 8½ megabytes) is going to make a killing. Because of the automatic RAM-disk support in AmigaDOS (one of its few virtues), I suspect that a majority of Amiga owners would rather purchase a cheap RAM box than a not-so-cheap hard-disk drive, especially if the RAM box can use either

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I still like the Amiga; it's threatening to replace the Mac as the machine on which I do most of my programming. But unless Commodore gets behind it and pushes, with better production, marketing, and support of hardware and software developers, the Amiga will probably be relegated to pattering along for most of 1986. Of course, the next two Amiga machines under development could improve the situation quite a bit, but Commodore still needs to make some smart moves and lay the groundwork for the entire line.

APPLEWORLD CONFERENCE

Apple, on the other hand, has been making smart moves for some time now. One was scheduling a special AppleWorld Conference to announce new products and new directions to the press, dealers, and analysts. This solved a number of problems. First, it reduced attendance at the annual shareholders meeting, which has been so crowded for the last two years that shareholders have ended up sitting outside. Second, by holding it during the first day of the MacWorld Expo, Apple allowed the exhibitors to show off the Mac Plus (and products for it). Since the MacWorld Expo was scheduled for the week before the annual shareholders meeting, there would have been some real problems doing that had Apple decided to wait until that meeting to announce the Mac Plus.

From comments made by John Sculley, Del Yocam, and others, it appears that Apple has found its direction again after two years of trying to kill off the Apple II, ignoring its users and dealers, and promoting the "computer-as-toaster" concept. Apple has committed itself to upgrading the Apple II line, apparently using the 65802/65816 line of processors from the Western Design Center. You may remember that Steve Wozniak was working on such a system two years ago (the "Apple IIx"), and was ordered by management to stop. Well, it looks like Woz is doing consulting work for Apple now, and it's not hard to guess what it's probably for.

Sculley also announced a plan to establish direct ties between Apple and the hundreds of Apple users groups around the world. Again, this represents a big change from Apple's self-assurance (arrogance?) of many years. For example, had Apple bothered to take a prototype Mac around to a dozen or so users groups and listened to the feedback, the original Mac might have looked more like the Mac Plus (or the Mac with slots) instead of the limited, crippled machine it was. Apple's move to tap the resources of users groups and to build good relations with them is a smart move indeed.

Apple finally acknowledged what folks have been saying about the Mac since its release: To survive in the long run, the Mac needs an open architecture (and spare me comments about "virtual slots," a buzzword that Apple was tossing about two years ago and that quietly died). So Apple is going to build an open-architecture Mac. It says so, right there on page 17 of Apple's 1985 annual report. About time. If Apple is really smart, it will kill off

(continued)

the 512K-byte Mac, push the Mac Plus down to less than \$1500, and bring out the Mac with slots at around \$2500. Given the great advantage the Mac has with third-party software and hardware, such a move would have a painful impact on both the Amiga and the ST.

All in all, things are looking better for Apple than they have for some time. Its financial situation is excellent: debt-free, and more than \$300 million in the bank. Apple is planning to spend \$100 million on R&D this year—a 50 percent increase over last year—including some \$15

Table 1: A comparison of features for Macintosh, Atari ST, and Amiga computers.

	Macintosh	Mac Plus	520ST	1040ST	Amiga 1000
System cost					
no monitor	---	---	\$600 ¹	---	\$1500 ²
monochrome	\$2000	\$2600	\$800 ¹	\$1000	---
color (RGB)	---	---	\$1000 ¹	\$1200	\$2000 ²
RAM	512K	1Mb	512K	1Mb	512K
maximum upgrade	512K	4Mb	512K	1Mb	8.5Mb
nonstandard	4Mb	?	1Mb	?	---
OS	proprietary	proprietary	TOS	TOS	Exec/AmigaDOS
Graphics routines	Toolbox	Toolbox	GEM	GEM	ROM/Intuition
User interface	Finder	Finder	GEM Desktop	GEM Desktop	Workbench
ROM	64K	128K	192K	192K	256K ³
Clock speed (MHz)	7.83	7.83	8.0	8.0	7.18
Disk storage	400K	800K	360K	720K	880K
after formatting	399K	798K	349K	709K	876K
Built-in disk drive	yes	yes	no	yes	yes
# of external drives	1	1	2	2	3
Hard-disk port	---	SCSI	DMA	DMA	---
Serial port	RS-422(2)	RS-422(2)	RS-232C	RS-232C	custom
Parallel port	---	---	IBM DB-25	IBM DB-25	custom
Mouse ports	1	1	2	2	2
Expansion bus	---	---	---	---	86-pin external
Other ports	---	---	MIDI, cartridge	MIDI, cartridge	---
Graphics modes	512x342x1	512x342x1	640x400x1	640x400x1	640x400x16 ⁴
	---	---	640x200x4	640x200x4	640x200x16
	---	---	320x200x16	320x200x16	320x400x32 ⁴
	---	---	---	---	320x200x32
Special modes	---	---	scan line ⁵	scan line ⁵	hold-and-modify ⁶
Color table	---	---	512	512	4096
RGB output	---	---	RGB (9-pin)	RGB (9-pin)	RGB/RGBI (23-pin)
Other output	---	---	mono, NTSC, RF	mono, NTSC, RF	NTSC, RF
Graphics hardware	---	---	---	(add-on board) ⁷	Blitter, coprocessor
Sound	1 DAC	1 DAC	sound chip	sound chip	4 DACs
Voices	up to 6	up to 6	up to 3	up to 3	up to 16
Output	mono	mono	(monitor)	(monitor)	stereo, RF
MIDI	3rd party	3rd party	standard	standard	option
Keys	57	78	95	95	89
Function keys	---	---	10	10	10
Numeric keypad	no	yes	yes	yes	yes
Cursor keys	no	yes	yes	yes	yes
Detached keyboard	yes	yes	no	no	yes

¹ Add \$100 for a double-sided drive instead; neither drive is built in

² Price assumes \$200 upgrade from 256K to 512K

³ Write Control Store (WCS); loaded in from Kickstart disk

⁴ Interlaced

⁵ Color table can be (must be) redefined for each scan line

⁶ Each pixel can be a modification of the color to the left; theoretically allows all 4096 colors

⁷ Atari plans to release a board with hardware graphics support

? I don't know

--- not available

million for a Cray supercomputer, which Apple says it will use to simulate new hardware and software architectures. And there has even been an out-of-court settlement of the suit with Steve Jobs, on terms that appear to be very favorable to Apple.

It must be said that Apple is working under a number of handicaps, though. The "Apple IIx" would have been a better release two years ago than the IIc, which even Apple—in a backhanded sort of way—acknowledges hasn't sold as well as hoped. The annual report talks about the massive installed base (2.3 million units) of the II, II+, and IIe systems, then refers to the "strong seasonal sales" of the IIc and their hopes that "more IIc's will show up" in homes. And, as mentioned, the Mac Plus is what the Macintosh should have been two years ago. But what's important is that Apple is making smart moves, is headed in the right direction, and has the finances and other resources to survive what Apple and most analysts agree will be a flat year for sales in 1986.

SYSTEM STATUS

Table 1 is an attempt to make an honest, rational comparison of features between the Mac, ST, and Amiga computers. This approach has some inherent limitations, mostly because of a lack of room to comment on the quality of the features (like keyboard layout or mushiness, etc.). You'll also notice that I've avoided the "\$X99" syndrome; if a system lists for \$1999, I give the price as \$2000. That helps to avoid the psychological blind spot that makes us think the system is cheaper than it actually is. I assumed a minimum of 512K bytes of RAM and one disk drive for each system, which is reflected in the prices for the 520ST (with a single-sided drive) and the Amiga (with the RAM upgrade from 256K to 512K bytes).

The section on RAM was hard to lay out. The first line ("RAM") gives the amount in the system being purchased. The second line indicates the amount of RAM the hardware and software are designed to accommodate. The third line shows how far the machines have been expanded by nonstandard upgrades (which usually, though not always, void the warranty).

The section on graphics was also difficult to put together because of the different modes, outputs, and (yes) problems. It doesn't indicate, for example, the irritating flicker of the interlaced mode on the Amiga, nor does it show how difficult it is to use any non-Atari RGB monitor with the 520/1040ST.

Can any conclusions be drawn from this one table? About the only safe assumption is that the ST computers offer the most features for the price. You can't really make decisions about performance, ease of use, or amount of software available. But at least you can see how the computers stack up against one another.

SOME BENCHMARKS

Table 2 is another attempt—albeit a simple one—to measure the relative merits of these same computers in different areas. I tried to use at least two languages (or

(continued)

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two compilers) on each machine, just to avoid bad times based on the language used. On the Macintosh, I ran the same benchmarks in both TML Pascal and Consulair C; the TML times were faster across the board and are shown on the chart. On the ST, I used a mixture of four languages: Digital Research's (Alcyon) C, TDI Modula-2/ST, Personal Pascal, and Hippo C, picking the best times from each. Digital Research's C gave the best times, when I could get it to run; however, hardware difficulties and possible failures on my part limited me to using it for just the performance benchmarks. On the Amiga, I used Lattice C (version 3.03B), then reran the benchmarks using a beta copy of Aztec C; Aztec C generally produced faster times. Also, be aware that I did not use register variables for any of the C routines on any machine, with one exception: the circle-painting routine I had to write for the Amiga (which doesn't have any built-in circle routines).

The first section shows times (in seconds) for three different "performance" benchmarks: the Sieve of Eratosthenes routine; a matrix multiplication routine, using 50 by 50 integer matrices; and a routine that creates a list of 1000 random numbers, then sorts them using the Quicksort algorithm. As could have been and was predicted, the ST was the winner thanks mainly to Digital Research's C. The other three languages used on the ST produced times slower than Aztec C on the Amiga. The

Amiga came in second—even though it has the slowest clock speed—thanks largely to the beta copy of Aztec C; the Lattice C times on the Amiga weren't nearly as good. Finally, the Mac and the Mac Plus came in last.

The next section contains graphics benchmarks, showing how well the different systems perform common tasks. All were done in "monochrome" mode; that is, the ST benches were run using the Atari monochrome monitor, and the Amiga was set up with a 640-by 400-pixel (interlaced) display and a single bit plane. I hope to have some follow-up times next month showing color-graphics performance for the ST and the Amiga.

The first two groups give times for drawing straight lines at different angles. The "offset" value indicates a skew to one side. Vertical lines with an offset of 0 are truly vertical, going from, say, the point (200,100) to the point (200,300); the same line with an offset of 20 goes from (180,100) to (220,300). As you can see, there's a wide variety of times. With just one exception—horizontal lines with an offset of 0—the Amiga is anywhere from 2 to 30 times faster than the other four computers. The ST is usually in second place, followed by the Mac Plus and then the Macintosh (which is horribly slow at drawing vertical lines with any slew at all).

The third group shows times for painting (i.e., drawing

(continued)

Table 2: Benchmarks on Macintosh, Atari ST, and Amiga computers. All times are in seconds.

		Amiga 1000
Performance		
Sieve of Eratosthenes	6.2	5.1
Integer Matrix	7.5	6.8
Quicksort	9.8	8.2
Graphics (monochrome)²		
Vertical lines		
offset = 0	12.9	6.5
offset = 1	87.2	6.7
offset = 20	87.2	6.7
offset = 100	86.8	6.7
Horizontal lines		
offset = 0	3.4	3.2
offset = 1	5.6	3.4
offset = 20	12.9	3.4
offset = 100	43.8	3.4
Paint rectangles	17.8	5.9
Paint circles	9.4	86.4 ³
Write text	1.0	1.4
Disk I/O		
Write File	2.3	7.3
Read File (sequential)	1.1	5.1
Read File (random) ⁴	4.6	17.8

¹ Not actually run on the 1040ST; however, Atari claims no performance increase for the 1040ST

² The Amiga was in 640 by 400 (interlaced) mode with a single bit plane

³ There are no built-in circle routines; this is a Bresenham algorithm that I implemented

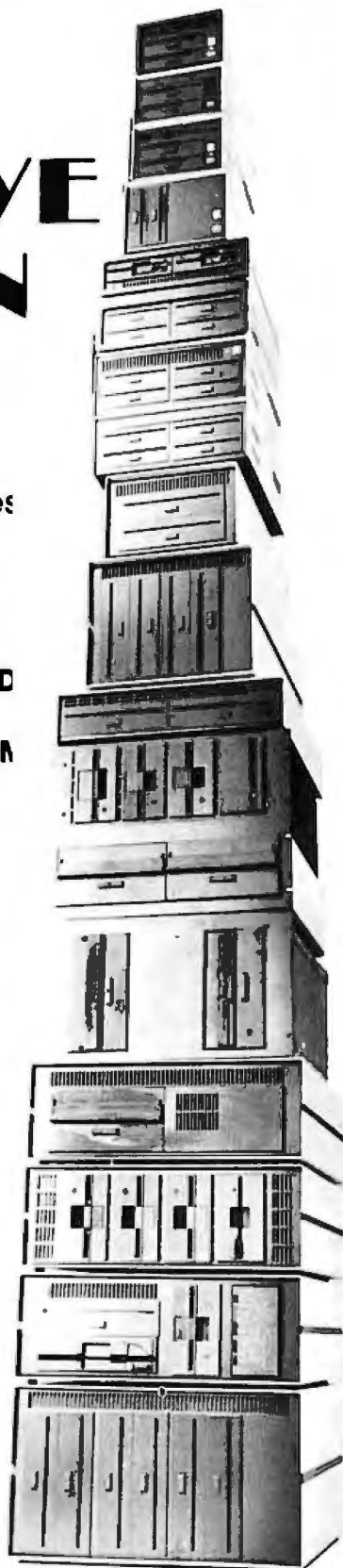
⁴ Times are an average value based on five trials

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ACCORDING TO WEBSTER

solid) rectangles and circles and writing text to the screen. The rectangle benchmark draws 2000 solid rectangles (half black, half white) to the screen; again, the Amiga wins, though the Mac Plus and the Mac aren't that much slower (three to four times, respectively), and the ST comes in last.

The circle benchmark does much the same as the rectangle but puts only 400 circles on the screen. The Mac Plus and the Mac are the big winners here; I'd love to have a copy of the algorithm used in QuickDraw. The ST is much slower than the Mac but still "beats" the Amiga. Why? The Amiga graphics libraries don't have built-in circle routines, so I implemented—in C—some based on Bresenham's algorithm. It works nicely, but, as you can see, the performance leaves much to be desired. It's not really an accurate measure of the Amiga's graphics power, but it is a fair measure of what you'll face if you want to draw circles on the Amiga.

The text benchmark puts up some 3800 characters: a 40-character line of each of the printable characters (ASCII codes 32 through 126). I should have made this benchmark last longer, since the times are so short that accurate measurement and comparison are difficult; however, I don't have access to a Mac Plus right now, so I can't re-run the benchmarks. The Mac Plus wins, with the Amiga and the Mac not that far behind it; the ST, however, is quite a bit slower.

The third section deals with disk I/O. The Write File benchmark writes sixty-four 512-byte blocks out to a file on the disk, resulting in a 32K-byte file. The Read File (sequential) benchmark reads the file back in the same way it wrote it, that is, blocks 0 through 63. The Read File (random) benchmark first creates a randomly organized list of the block numbers (0..63), then reads in the blocks in that order. Because the order of the blocks can affect performance, I ran five trials for each computer, then calculated the average. Interestingly enough, the Mac Plus comes out best, with the much-maligned Mac not far behind, followed by the Amiga and (surprisingly) the ST coming in dead last (except on the random-access read, which the Amiga lost). I was startled to see the times on the ST and ran the benchmarks in both Hippo C and Personal Pascal, getting nearly identical times for each. If I can ever get Alcyon C to work, I'll run the benchmarks with that as well and see if the times vary significantly.

Though table 2 may look impressive, it's really an incomplete measure of the relative powers of the different machines.

MACWORLD EXPO

Technically, this was the MacWorld Expo & Apple II World Expo, but Mac exhibits and products dominated. What really dominated, though, was a sense of energy and excitement that I haven't seen at a computer show since the West Coast Faire back in 1982. And it was the first computer show in months (if not years) that I was able to enjoy.

Ironically, the two most interesting software products I saw were both alpha versions, that is, pre-prerelease. Andy

(continued)

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ACCORDING TO WEBSTER

Hertzfeld was showing off *Servant*, a new Macintosh user interface that can best be described as a cross between the Finder and Hertzfeld's *Switcher* program. You see the regular Finder desktop, but when you double-click an icon, it opens the application as a window on the desktop itself. The currently active (top) window determines which application is active (and how the menu looks), and when you close a window, it collapses back down to its icon on the desktop. Hertzfeld plans other enhancements, like being able to open up a file so that you can see and manipulate its resources as icons. Some issues still need to be worked out (memory allocation, dealing with applications that use the entire desktop), but I liked what I saw. Hertzfeld estimated that he had six months' more work to do, which would give a very tentative release (probably beta) date of July.

The second package, *Super Paint*, was being demonstrated by Silicon Beach Software. *Super Paint* looks like a combination of *MacPaint* and *MacDraw*; that is, you can toggle between the bit map and object-oriented graphics and can, in fact, mix them, with the object sitting "on top of" the bit-map background. It supports multiple windows, different levels of *FatBits*, a variety of tools and options, and full-screen painting. SBS was quoting "summer" as the release date, but it may be out within a month or so of this issue hitting the stands.

The two most interesting—and expensive—hardware products were the *HyperDrive 2000* from General Computer Corporation and the *MacSuper 20 FP* from Levco. The *HD 2000* upgrades your Mac to a 12-MHz 68000, increases your RAM to 2 megabytes, sticks in a 68881 floating-point processor (FPP), and, as you might expect, includes a 20-megabyte internal hard disk. The entire upgrade costs \$3195. (Incidentally, GCC also dropped the prices of the *HD 10* and *HD 20* by \$500 and \$600, respectively—undoubtedly in response to the competing internal hard disks coming out on the market.)

The *Levco 20 FP* is for power freaks only. Rich power freaks. It upgrades your Mac to a 16-MHz 68020, with 4 megabytes of RAM, an SCSI port, a 68881 FPP, and a 20-megabyte internal hard disk. The cost? As the saying goes, "Anyone who has to ask the cost can't afford it." But Levco says "under \$9000." One of the reasons the price is so high: It uses 1-megabit chips, which have not gone into mass production and (according to Levco) cost about \$100 each. Cheaper versions use 256K-bit chips (and hold less RAM); the disk drive and the 68881 chip are also optional.

Interestingly enough, software support for both systems is appearing almost immediately. *Consulair* announced a version of its C compiler that would provide direct support for the 68881 and another version that would produce code optimized for the 68020. TML Systems (TML Pascal) is also considering the same approach. Both the *HD 2000* and the *20 FP* let you get at the 68881 right now by patching in through the *SANE* (Standard Apple Numeric Environment) routines (floating-point code in the Mac Toolbox), but direct calls can only help to speed things up.

ACCORDING TO WEBSTER

I ran my benchmarks on the HD 2000 and 20 FP while I was there. I don't want to print them here since neither system was a "released" version, but I can give you some idea as to how both did. The HD 2000—which had the old Mac ROMs—showed almost exactly a 50 percent increase in speed for the performance benchmarks (sieve, matrix, sort). However, the graphics and I/O routines ran at almost exactly the same speed as a regular Macintosh. (Note that the I/O benchmarks ran off a floppy disk and not the internal hard drive.) The 20 FP—which had the new Mac ROMs—ran two to three times faster than the Mac or the Mac Plus on the performance benchmarks. On the graphics benchmarks, it ran on the average about 50 percent faster than a Mac Plus and so was two to four times faster than a regular Macintosh. The I/O times (which, like the HD 2000, were off a 400K-byte disk drive) were significantly (four times) faster for writing but not that much faster for reading.

I do hope to get my hands on the final versions of both products and review them. When I do, I'll devise some benchmarks that do a better job of showing the strengths of each (disk caching, floating-point processing, fast hard disk, etc.).

A number of other products were being shown, though seeing does not necessarily mean believing. Several companies announced internal hard disks (à la HyperDrive), though none were shipping at the moment. The folks from Step Lively Software, who last fall announced their On Stage Pascal compiler for the Mac, had a booth, but they indicated they were still a few months away from shipping even a beta version. Borland also got into the act by announcing (though not showing or releasing) Turbo Pascal for the Mac. The release date given was "end of first quarter 1986" (i.e., late March), but company officials were already talking about that slipping into the second quarter of 1986. Meanwhile, Tom Leonard (TML Systems) was busy selling real copies of TML Pascal and signing site licenses with several universities. Leonard even spent an entire afternoon with a vice president from Borland. Frankly, given the high quality and low price of TML Pascal, Borland could do a lot worse than to just buy the rights and market it as Turbo Pascal for the Mac. We shall see.

It was a fun show; everyone seemed to have a good time, myself included. The biggest improvement that could be made to the show would be to open it up to other 68000-based systems (Commodore, Atari, Stride, and others) and their respective third-party developers. The friendly (and not-so-friendly) competition would add a nice edge to the show, not to mention a good deal of variety. . . and, of course, would draw a much larger audience, including those who want to purchase a 68000 machine but haven't decided which one to get. Now that could be a fun show.

Well, that's it for this month. I'll lay off the wars a little next month and (again) try to look at some of the software and hardware that has been piling up. I'll also try to catch up with the mail that's been accumulating since before Christmas. Sigh. Until then, see you on the bit stream. ■



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were vital! Everything speeded up by *huge* factors!

I agree, it makes for messy-looking code. It also makes you more careful when changing routines not to use extra registers without cross-referencing and changing all register saves.

But—and it's such an important *but* that it deserves emphasis—the *code runs faster!* That is excuse enough for me to do it! Anything that saves me a cycle here and an instruction there is worth it! I'm battling to retain a 20-frame-per-second rate. Every cycle counts!

I'm sure all game programmers are in the same boat. I'm not the only person who writes time-critical code!

ATARI ST

This month, several BIX members discuss C compilers for the Atari ST and address some specific problems in using those compilers that are not well documented. Other topics include an improvement to the RAM-disk program given previously in the conference and color monitor considerations.

LATTICE C COMPILER

atari/tech.st #233, from cheath [Charlie Heath, MicroSmiths]

Is the Lattice C compiler the same as the Amiga compiler, or were they developed independently? It would sure be nice to be able to make direct ports.

atari/tech.st #234, from shersee [Steve Hersee, Lattice Inc.]
a comment to 233

They are the same compiler linked to different run-time libraries. If you have other questions, please ask them in the Lattice conference.

COLOR MONITORS

atari/tech.st #235, from jedwards [Jon Edwards, Technical Editor, BYTE]

Got a letter from a reader today interested in knowing if there's any hope in attaching a non-Atari color monitor to his ST. Anyone have any experience here?

atari/tech.st #237, from dmenconi [Dave Menconi, co-moderator of Atari conference]
a comment to 235

As you may know, the new "consumer" 520ST has a composite video output. The older version has a space on the board for the hardware. I understand from Neil [Harris] that it is difficult but not impossible to add the hardware.

atari/tech.st #238, from bwebster [Bruce Webster, Consulting Editor, BYTE]
a comment to 235

Jez San hacked together a connector for his ST—with emphasis on the word "hacked." Not an easy thing to do. Somebody could probably make a small amount of money producing ST-to-something connectors. I'd be more interested in hooking my ST color monitor to the Amiga.

atari/tech.st #240, from neilharris [Neil Harris, Atari Corp.]
a comment to 238

I know you will think this is a snide comment, but the ST color monitor on the Amiga will not look as good as it does on the ST, which should prove to any doubters that we have some interesting video technology on our side. Fact is, the ST pumps out a significantly higher bandwidth

signal than the Amiga. That shifter chip is very slick. Maybe you should try it, Bruce—that would be interesting for your comparison column.

atari/tech.st #241, from bwebster
a comment to 240

If I could hack together a connector, I would—but the Atari monitor uses an impossible-to-find and difficult-to-hack connector. If you folks want to put one together, I'll cheerfully test it out and report on the results.

520ST OPERATING SYSTEM

atari/tech.st #244, from nkline [Nick Kline]

This is from an IBM PCer who is thinking about buying an ST at that incredible new price. I was wondering if the operating system does multitasking, because I really don't know much about it.

atari/tech.st #245, from skrennek [Steve Krennek, Krentek Software, co-moderator of Atari conference]
a comment to 244

No, the ST operating system is not multitasking. There have been some folks making noise about the possibility, but I would be surprised if it happens anytime soon. Any comments, Neil?

atari/tech.st #246, from neilharris
a comment to 245

No, TOS is not multitasking. However, it appears that OS-9—a multitasking, UNIX-like operating system that's available for the Tandy Color Computer—is about finished for the ST. I do not know much more about it. Also, 4xFORTH, a FORTH-83 development system, supports multitasking.

atari/tech.st #250, from jsan [Jez San, Argonaut Software]
a comment to 245

The ST itself doesn't inherently multitask, but I believe that GEM's Desk Accessories can manage it (I'm not familiar with the techniques).

It's only GEM itself that prevents the ST from multitasking, so any third-party software producer can come up with an alternative operating system (e.g., UNIX) that can multitask. There is no reason why the ST can't do it, assuming you write the appropriate software.

atari/tech.st #252, from jriley [John Riley]
a comment to 244

Yes and no. The operating system has limited multitasking capabilities, but the software does not exploit it (yet). However, the silly thing is so fast that you won't miss it.

DIGITAL RESEARCH C QUESTIONS

atari/tech.st #254, from wshubert [William Shubert]

I have some questions about DRI's C compiler, which I have been using for about three weeks now. In the first place, can anyone agree about the complaint made in comment #170 that the compiler's structures are all messed up? I haven't found any such problem yet, but I would like to be sure of this.

Also, has anyone written a better RAM-disk program? I don't have the new ROMs yet, but I have a double-sided disk drive and don't want to have to boot up with a single-sided disk in the drive once I get them. By the way, anybody who complains about the speed of the DRI compiler obviously hasn't used it on a RAM disk yet—when I store everything on the RAM disk, what used to take 10 minutes now takes about 1.

atari/tech.st #255, from dbetz [David Betz]
a comment to 254

I ported XLISP to the Atari ST and never had any trouble with structure offsets. My only problems were with the lack of a "setjmp.h" include file and the fact that console I/O using the standard library didn't work. I'm now trying to use a beta-test copy of Megamax C for the Atari. I'll post any impressions as I proceed.

atari/tech.st #258, from cheath
a comment to 255

Maybe we have an early version of the compiler. It created offsets that were wrong some of the time. We looked at the output, it was random, we changed to explicit calculations of offsets.

atari/tech.st #259, from wbaker [Bill Baker]

I have three compilers for the ST:

1. Hippo C—not very good, really.
2. Megamax C—first impression was very good even though I received a prerelease version. After much use I find the current editor impossible and the (slightly) altered Mac documentation a problem. Every two or three weeks they promise that the final release will be ready in two or three weeks.
3. TDI Modula-2/ST—very good and only \$60. Pretty neat editor, very good documentation (if you have some programming experience). On the other hand, Modula is really tough if you're used to C.

By the way, I just got an Abacus book on GEM internals. Not bad if you have no other documentation. The VDI section is OK, but the AES section is impossible. Seems like two separate books glued together.

atari/tech.st #263, from wbaker
a comment to 259

Does AES have a function called "fsel_input()"? Hippo C supports it, calling it an AES routine. My Abacus GEM programmer's reference says nothing about it. According to a Hippo experiment (and provided source), "fsel_input()" takes a path and file name and pops up a GEM File Selector box. The selected file is returned to the caller.

atari/tech.st #264, from neilharris
a comment to 263

"fsel_input" displays the File Selector dialog box and monitors the user's interaction with it. The File Selector library returns the results of this interaction between the user and the dialog to the application.

Parameters:

```
control(0) = 90
control(1) = 0
control(2) = 2
control(3) = 2
control(4) = 0
int_out(0) = fs_ireturn
int_out(1) = fs_jexbutton
addr_in(0) = fs_iinpath
addr_in(1) = fs_iinsel
```

fs_ireturn = 0 means an error exists, >0 means no error
fs_jexbutton = 0 means cancel box selected, 1 = OK box selected
fs_iinpath = address of buffer holding directory specification
fs_iinsel = address of buffer holding file specification

Sample call to C language binding:

```
fs_ireturn = fsel + input(fs_iinpath, fs_iinsel, &fs_jexbutton);
```

(continued)

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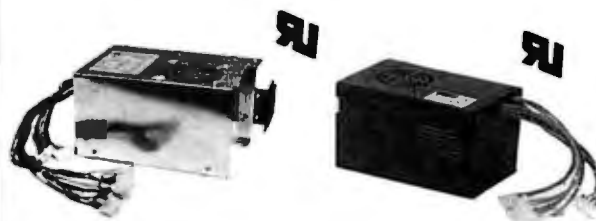
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ANOTHER QUESTION

atari/tech.st #266, from wbaker

Thanks, Neil, for the help with "fset_input()". Looks like it will do what I need.

Now, another question: Has anyone had any problems with "vqt_extent()"? As I understand from the Abacus book, the function will calculate the dimensions of a string (in pixels, I assume) given the current text attributes:

```
vqt_extent(handle, string, extent)
int handle;
char *string;
int extent[8];
```

Every time I call it, I get three little mushroom clouds. I think this means an addressing error. Anyone seen this or gotten it to work? I'm using Megamax C. Could it be their implementation?

atari/tech.st #269, from neilharris
a comment to 266

When passing the string to the "vqt_extent" function, each character of the string goes into elements of the "intin[]" array. Set "string=intin". The results are passed back through "ptsout[0 to 7]". Does that help?

IMPROVED RAM DISK

atari/tech.st #270, from wshubert

I have just made my RAM disk boot up instantly. I changed the "main()" subroutine to read:

```
main() {
    register int i;
    appl_init();
    for (i = 0; i < 4608; ++i)
        data[i] = 0;
    Protobt(data, 0x8000L, 2, 0);
    xbios(38, install);
    sleep(); }
```

This makes it go instantly, and you don't have to delete a bunch of junk from it each time you boot up. (Oh yeah, the original listing of the disk is in comment #54 here.)

However, I don't understand the "Ptermres()" call listed in the hitchhiker's guide. What should you pass as the parameter? The length of the program? Its address? I don't get it. If anybody could answer that, it would be nice.

atari/tech.st #276, from jtittsler [Jim Tittsler, Atari Corp.]
a comment to 270

The Ptermres (Terminate and Stay Resident) call takes two parameters:

```
Ptermres(keep, returncode);
LONG keep;
WORD returncode;
```

The keep parameter specifies the total number of bytes to keep for this program/process. This number includes space used by text/code, data, bss, and the basepage (don't forget to add that \$0100!). The returncode is the result returned to the parent (parallel to that returned by the Pterm() function).

A FEW NOTES FROM A FRUSTRATED PROGRAMMER

atari/tech.st #277, from jruley

I've been working since Christmas with the Hippo C compiler and the Abacus GEM and internals books. I am now in a position to give a solid warning to anyone planning to do software development on the

ST: Get the developer's package! It is possible to do some nice stuff with Hippo C, but it is not easy. You have to write your own XBIOS interface and get your documentation out of books—which right now means Abacus.

My first impression of the Abacus books was pretty good, but after the last few weeks, I am not satisfied. Only about two-thirds of the AES calls are documented (they even left out "fset_input," which has to be the most commonly used AES function on the ST!), and the documentation is not especially clear on what's left. It took me almost a week to discover that arguments to the VDI and AES functions are supposed to be 16-bit integers while Hippo C defaults to a 32-bit integer type. To sum up, it is possible to program this way, but it's no fun at all! No matter how irritating that extra \$300 for the developer's package may seem, it's worth every penny.

atari/tech.st #280, from wbaker
a comment to 277

I agree! Hippo and Abacus are not a good combo. I have a feeling that Megamax is significantly better, although I am still waiting for the "real" release. The interim release is barely worth it. As a long-time C programmer I would like to see a good C development environment. But the TDI Modula-2/ST product is so good that I am really considering switching. The GEM documentation really consists only of the various GEM VDI and definition modules. This is still way ahead of anything Hippo or Megamax has released. Unfortunately, we are still stuck with the Abacus books. But Abacus and TDI Modula-2/ST together are under \$100.

atari/tech.st #281, from jruley
a comment to 280

Yeah, but the Abacus GEM book is just not enough! It leaves out a bunch of the AES functions, it does not explain how to create the files necessary to support drop-down menus, the index is incomplete, and the organization is lousy—for all of which, it's such an improvement over what I had (Hippo C "documentation") that I'm still almost happy with it. I'm not quite structured enough for Modula, but I need floating point bad—any suggestions?

IBM RGB MONITOR FOR ATARI ST?

atari/tech.st #278, from jlwright [Jim Wright]

I'm about to get an RGB monitor for an IBM PC project but plan to get an ST as soon as possible. Are there any RGB monitors that will work well with both? I'd like a fairly crisp (readable) display but don't want to go bankrupt either. Thanks for all comments.

atari/tech.st #279, from jtittsler
a comment to 278

The ST produces an analog RGB signal (3 bits each of red, green, and blue) while monitors intended for use with the IBM Color Graphics Adapter expect 1 bit for each color, plus an intensity bit. I believe the IBM Enhanced Graphics Adapter produces an analog RGB output, but I have no experience with it or its monitors.

DBASE II FOR 520ST?

atari/non.tech.st #218, from Ischmittroth [Louis Schmittroth]

Does anyone know of an interpreter or compiler for dBASE II (or III) for the 520ST? I have a number of dBASE II programs on my Kaypro that I would like to move to my 520ST. I would also appreciate any information on other usable database systems on the ST.

atari/hon.tech.st #219, from neilharris
a comment to 218

You are in luck! Mirage Concepts of Fresno, California, started shipping their dBASE II interpreter last week under the title H&D Base (using their brand name, Holmes & Duckworth), and it looks very good.

OFFICIAL ATARI CORP. BBS IN SUNNYVALE
atari/news.st #228, from neilharris

Atari Corp. sponsors a bulletin board system called Atari Base. Operating in a small room in the heart of Atari's corporate headquarters in Sunnyvale, California, Atari Base takes well over 1000 calls per week, providing news, technical support, user group lists, and software downloads for all Atari computers. Atari Base currently consists of four systems on four separate lines. Two lines are STs complete with Atari 20-megabyte hard disks, and the others (the original two lines) are Atari 800s with Corvus hard disks. The two new lines were added recently due to heavy load, while the others have been running continuously since last August. Atari Base operates around the clock, every day. You can reach Atari Base by calling (408) 745-5308.

IBM & COMPATIBLES

MS-DOS is the featured conference for this month. The conference members engaged in a wide-ranging discussion on the use of batch files, learning to use Debug, handling directories, and resolving problems with formatting a hard disk, among other subjects.

BURNING IN NEW COMPUTERS
ms.dos/batch #56, from jrobie [Jonathan Robie]

I occasionally burn in computers for friends. At present I use a batch file which fills a RAM disk from a disk drive, then copies the RAM disk to the screen, and finally deletes all files on the RAM disk before looping to the beginning.

I have two questions. Is this the best way to approach burning in? And, is there any way to do a global delete without confirmation in a batch file?

ms.dos/batch #57, from bomb [Jerry McReynolds]
a comment to 56

Jrobie, a quick answer to your question on DEL *.*. Create a file (! name it YES.DAT) that consists of three characters: y, <CR>, <EOF>.

```
COPY CON YES.DAT
y<CR>
F6<CR>
```

The .BAT file could then use the DOS command DEL *.* <YES.DAT> >NUL.

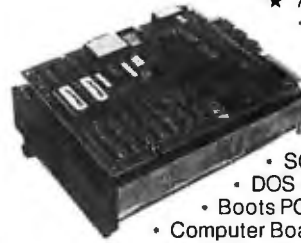
Redirection of "stdin" and "stdout". The < character tells DOS to use YES.DAT as its input file, instead of CON. The > character tells DOS to use NUL for its output file, instead of CON.

As far as burning in goes, most manufacturers test their subassemblies (boards, power supplies, disk drives, etc.) before they are assembled. Then they test the final assembly. With all that testing going on, why worry about burning in?

Our company has 11 XT's, none burned in, and no failures to date. My home unit is a bit over two years old (aboriginal); I took the thing from its unopened container, added a few extras, and have yet to have a problem with it. Knock on wood!

(continued)

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Hannover Fair: Atari Shows PC Box, German Firm Announces Supercomputer

At the opening of the Hannover Fair in West Germany, Atari exhibited its IBM PC compatibility box for its 520ST and 1040ST computers. The box had its own 8088, a socket for an 8087, and 512K bytes of RAM. It connects to the ST via the DMA port. With the product's introduction at least several months away, Atari representatives wouldn't discuss pricing except to reaffirm the company's policy of producing in "high volume at low cost."

IP Systems, of Karlsruhe, West Germany, announced but did not show the TX2 series of supercomputers. The result of work done by researchers at Karlsruhe University, the parallel-configuration machine is based on the 80286 and has at least 16 chips. It can perform 10 million to 30 million instructions per second. The TX2 uses neither arrays nor vectors. Its parallel architecture is based on an extended tree structure. The machine represents a new type of parallelism that could apply to functions beyond the typical uses in floating-point math, for example, in the types of calculations used in expert systems, optimization, and other non-numeric tasks.

Toshiba exhibited three optical disk products it said will be available to consumers late this year. Toshiba also showed two plasma-screen laptop computers, the T2100 and the T3100, compatible with the IBM PC XT and AT, respectively. Ing. C. Olivetti also brought PC compatibles to the Fair. Sanyo showed for the first time its SPX-840 LED printer, said to rival laser printers in print quality and performance. The unit's method of printing involves electronic photography using an LED-array head and a selenium-tellurium photosensitive drum. Resolution is 400 dots per inch, and print speed is rated at 20 pages per minute.

A Norwegian company, Ask LCD, has come up with a flat-screen display for the IBM PC. At Hannover, it was suspended from a desk-mounted support arm. The unit measures 330 mm by 230 mm and is 25 mm thick. The screen surface is 250 mm by 160 mm.

Prospero Software, a British firm exhibiting at Hannover, announced a FORTRAN compiler for the Amiga and the Atari ST. Called Pro Fortran-77, it could help open up the 68000-based machines to technical and scientific applications.

NANOBYTES

Intel Corp., Santa Clara, CA, introduced the 80287-10, a 10-MHz version of its numeric coprocessor. The device operates at up to twice the speed of older versions. . . . In other Intel news, the company has enlisted the support of four software developers to provide compilers for its 80386 32-bit chip. **Silicon Valley Software**, Cupertino, CA, and **Green Hills Software**, Glendale, CA, said they will develop FORTRAN, C, and Pascal compilers for the 80386. **Ryan-McFarland**, Rolling Hills Estates, CA, said it's porting its standard FORTRAN and COBOL compilers to run on the chip. And **Language Processors**, Waltham, MA, announced it would develop COBOL, FORTRAN, C, Pascal, PL/I, RPG II, and BASIC compilers for the 80386. . . . **Apricot Computers**, Fremont, CA, said it will offer Microsoft's MS-DOS 4.0 as part of its XEN Multiuser System. . . . **NEC Electronics**, Mountain View, CA, and **Oki Semiconductor**, Sunnyvale, CA, have developed a CMOS version of NEC's μ PD7720 Digital Signal Processor. The new chip, called the NEC μ PD77C2 or the Oki M77C20, is a pin-for-pin replacement for the 7720 and draws only 24 mA, 80 percent less than its predecessor. . . . **PicTel Corp.**, Peabody, MA, has a desktop videophone system that transmits color video images over dial-up digital lines. PicTel said calls cost just twice that of ordinary phone calls, but the videophone setup costs \$150,000. . . . **SSI Software**, Orem, UT, unwrapped an operating shell for its WordPerfect and other SSI packages. WordPerfect Library is a RAM-resident program designed to enhance the performance of WordPerfect, MathPlan, and SSIData. . . . **Brown Wagh Publishing**, San Jose, CA, has released a word-processing program for the Amiga. Besides standard editing capabilities, Scribble provides four windows that can each hold a separate document. . . . **Personal Composer**, Honaunau, HI, has brought out version 2.0 of its Personal Composer music software. MIDI features include a 32-track recorder and a patch recorder. . . . Two United Kingdom companies have released products based on the Motorola 68020 32-bit CPU. **MicroAPL** of London launched a multiple-processor machine, the Aurora, that can handle as many as 64 users. Although it was designed to run the company's APL interpreter, it can be programmed in other languages. Another product using the VMEbus is the ET-68020 VME card from **Integrated Micro Products Ltd.**, County Durham. IMP said it has managed to make the 68020 run reliably at 25 MHz, at which speed it performs more than 10 MIPS in bursts. . . . **Apple Computer Inc.**, Cupertino, CA, is offering rebates to full-time teachers and college students who buy Apple hardware: \$75 on a IIc, \$150 on a IIe, \$175 on a 512K Mac, and \$200 on a Mac Plus. . . . **IBM's PC Convertible** is being built by robots at a plant in Austin, TX. The automated workers perform all assembly and test operations, and the assembly process reportedly takes 6 minutes.

ATARI 520ST MEMORY UPGRADE

I recently completed the Atari 520ST 1-megabyte memory upgrade modification as outlined by Gert Slavenberg on page 372 of the February BYTE. (Editor's note: Also, refer to the Atari/tech.st conference on BIX, message #239, and to ST.DOC from BYTEnet Listings.) It wasn't as easy as expected, and I'd like to share my experience with those tempted to add 512K to their machine for \$50 worth of dynamic RAM and a few hours of free time.

After piggybacking the new 120-nano-second DRAMS, I quickly soldered them to the old ones using a 35-watt iron. The joints did not look that good, but I buzzed out the board with the ohmmeter and all connections passed. When I finally booted up, erratic operations resulted. Most common among these were

- Black balloons on screen with system keyboard dead
- Display filled with dots
- Double menu images

After taking some aspirin, I proceeded to troubleshoot the board. Could my problems be traced to those DRAMS, which get very hot, making a cold-solder joint "colder"? My suspicions were confirmed when I shorted the connections together, one by one, and rebooting or erratic symptoms were triggered. I was able to get the modification to work properly by resoldering every connection slowly and carefully with a 15-watt pencil iron, examining each joint with a magnifying glass.

Here now are some pointers I'd like to pass on to anyone attempting to complete this memory upgrade modification.

Note 1: The modification does not work with the 16 despinning caps unconnected.

Note 2: After turning on the power, try to copy the system disk in one pass instead of two. If this works, run the memory test program outlined below.

Note 3: If you have little experience in doing chip soldering and debugging, I strongly suggest not doing this modification yourself. While being a major improvement to the ST, it can easily destroy your computer.

A simple test of system memory from BASIC can be quite informative. Issuing

the command `x=free(0):print x` returned 529,492 bytes available on my system. This number may seem low, but without the added memory only small programs can be written.

The following is a diagnostic program to quickly test out memory, 1K at a time. This program writes zeros and ones from the end of 512K bank 1 past the end (FFFF hexadecimal) of 512K bank 2.

```
5 rem memory test should run until
  address 1048574
6 rem test ability to write 0's and 1's to
  all blocks
10 for adr = 450000 to 2000000 step
  1024
20 bits = 0
30 GOSUB 200
40 bits = -32767
50 GOSUB 200
60 next
70 end
200 poke adr,bits
210 j=peek(adr)
220 print "address = ";adr,"data = ";j
230 if j<> bits then print "error ":stop
240 return
```

TOM DOLAN
Flushing, NY

SUPPORT NETWORK FOR THE HOMEBOUND

As someone who has been disabled since the age of five and who is currently telecomputing full time for a Fortune 500 insurance corporation, I would like to commend you for the excellent article "Working at Home with Computers" by Jane Morrill Tazelaar, which appeared in the March issue.

Disabled people are indeed creative, motivated, productive people. We have done excellent work in many fields over the years. We have been lawyers, doctors, teachers, and even a U.S. president. Now, thanks to the microcomputer and the modem, even the severely mobility-limited disabled person—the homebound person—is showing his or her potential.

Some of these men and women have expressed an interest in setting up a support network for homebound disabled workers. I think it is not only an excellent idea, but

it could open up new worlds for many of us homebound workers who are bright and creative but also terribly isolated. Therefore, anyone interested in being a part of such a network can write to me at Disability News Online, 257 Center Lane, Levittown, NY 11756. They can also reach me via CompuServe at 76505.656, via The Source at BCG138, or via PeopleLink at IOR860. I'd like to hear anyone's ideas, comments, or feelings about setting up such a network.

By the way, Disability News Online is a national newsletter by and for the disabled. It can be read on The Source by typing the following at the command prompt:

BASIC>SFILES>BCG138>DISABILITY-
NEWS-ONLINE.

ROBERT MAURO
Levittown, NY

PUTTING THE AMIGA TO GOOD USE

What's an Amiga good for? I seriously asked an Amiga salesman that question at a local Amiga Fest and the following conversation ensued.

He told me that the Amiga is the best personal computer ever made, and he asked me what I wanted a computer for. I said I was a scientist and did a lot of numerical work that required speed and accuracy. He explained to me how much faster the 32-bit 68000 Amiga is over the 8088 IBM PC family. I said that that may be and asked if the Amiga is faster or more precise than the 8087 in the IBM PCs. He admitted that the 8087 is faster and more precise, and maybe the IBM PC

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LETTERS POLICY: To be considered for publication, a letter must be typed double-spaced on one side of the paper and must include your name and address. Comments and ideas should be expressed as clearly and concisely as possible. Listings and tables may be printed along with a letter if they are short and legible.

Because BYTE receives hundreds of letters each month, not all of them can be published. Letters will not be returned to authors. Generally, it takes four months from the time BYTE receives a letter until it is published.

order to run iterative calculations.

Pro/Sci and Pro/Biz run on IBM PCs or compatibles with 128K bytes of RAM and MS-DOS 2.1 or later. Each calculator costs \$99 (plus \$5 shipping). For more information, contact Symsoft, POB 4477, Mountain View, CA 94043, (415) 962-9500. To order, phone (800) 227-6703; in California, (800) 632-7979. Inquiry 554.

UNIX for \$99

Wendin's multitasking, multiuser operating system for MS-DOS computers, PCUNIX, is packaged with a version of the Bourne shell, more than 70 commands, and complete source code for \$99. It can support two additional users on remote terminals connected to your machine's asynchronous communications adapters; as a multitasking system, it supports a mix of timeshared and real-time processes with an event-driven scheduler similar to that of a mainframe.

Wendin's microcomputer UNIX can run MS-DOS program images in both .COM and .EXE formats, and most MS-DOS system calls are translated to PCUNIX system services automatically and in real time. Extra system services for programming can be called from BASIC, FORTRAN, Pascal, C, and assembly.

The operating system, packaged on four disks, runs on the IBM PC family and compatibles with at least 384K bytes; it can be installed and run on a 5-megabyte hard disk. Contact Wendin Inc., Box 266, Cheney, WA 99004, (509) 235-8088. Inquiry 555.



The APC IV, NEC's 80286-based computer.

Relational Database Language for Atari 520ST

Mirage Concepts describes its H & D Base, a relational database management language for Atari's 520ST, as a dBASE II work-alike that's more than a storage and retrieval package. Providing almost 300 commands for manipulating data, the program can be used for building systems that handle inventories, accounts, and lists.

H & D Base works with most dBASE II command files and with all SDF and "delimited" data files. It lets you sort on any field to any level and provides full math capability on any field or variable. The number of records per file is limited only by disk capacity. You're allowed 97 fields per record, 250 characters per field, and 2000 characters per record. Numeric accuracy is eight digits.

The software incorporates a basic text editor, a help facility, a report generator, and a sample mailing-list program. H & D Base is not

copy-protected and sells for \$99.95. Contact Mirage Concepts Inc., 4055 West Shaw #108, Fresno, CA 93711, (800) 641-1441; in California, (800) 641-1442; in a foreign country, (209) 227-8369. Inquiry 556.

NEC Announces AT Compatible

NEC Information Systems' Advanced Personal Computer (APC) IV is the firm's first computer specifically designed for the U.S. market and its first computer inherently compatible with the IBM PC family.

The APC IV uses a NEC equivalent of the Intel 80286 microprocessor with a switchable clock speed of 6 MHz or 8 MHz; an 80287 math coprocessor is optional. The computer can accommodate 10.5 megabytes of RAM, with up to 1 megabyte on the motherboard itself (640K bytes is standard). Other standard features include two serial ports, a parallel port, and eight expansion slots, of

which two are 8-bit full-size slots and six are 8/16-bit full-size slots. The APC's detachable keyboard has 84 keys and a numeric keypad. Display options include the Advanced Color Display monitor (\$800), which has a resolution of 800 by 560 pixels. The Power Graphics Display Monitor (\$1495), scheduled to be available next month, has 1120-by-750-pixel resolution. Both monitors have multiscan capability with a scan rate of 15.75 to 32 kHz.

The computer comes with a 1.2-megabyte floppy disk drive and can accommodate a total of five internal storage devices. Options include a second 1.2-megabyte floppy disk drive (\$350), a 360K-byte floppy drive (\$300), and 20- and 40-megabyte half-height hard disk drives, which cost \$1400 and \$1800, respectively.

NEC offers three optional graphics boards with the APC IV. The Color Graphics Board (\$225) supports 640-by-200-pixel resolution and is compatible with IBM's Color Graphics Adapter. The Advanced Graphics Board (\$525) is compatible with both the CGA and IBM's Enhanced Graphics Adapter, supports all of the EGA's modes as well as software written for the Hercules graphics board, and comes with 256K bytes of memory. NEC also offers the Power Graphics Board (\$995), which is compatible with IBM's Professional Graphics Adapter. Available next month, the Power Graphics Board provides a resolution of 1120 by 750 pixels and can display 16 colors from a choice of 4096 colors.

The APC IV sells for \$3795 with a single 1.2-megabyte floppy drive; \$4645 with a 1.2-megabyte floppy and 20-megabyte hard disk drive; and \$5045 with a 1.2-megabyte floppy and 40-megabyte hard disk

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SOFTWARE • PROGRAMMING LANGUAGES AND AIDS

Modula-2 for Z80 CP/M

Workman and Associates is offering the FTL Modula-2 compiler for Z80 CP/M systems. A complete Modula-2. FTL has such features as separate compilation, procedures as parameters, open array parameters, and coprocesses.

The compiler supports real numbers with 15-digit accuracy, 2-byte integers from -32,768 to 32,767, and 2-byte cardinal numbers from 0 to 65,535. It does not offer a large integer type.

FTL provides version control through the linker, type checking between modules, and chaining between programs. It supports calls to the BIOS and BDOS of CP/M. The disk-based compiler directly creates Z80 code in the form of CP/M .COM files. Most of the libraries are written in Modula-2. The package's assembler is not compatible with other assemblers.

The editor's command structure is similar to WordStar's but adds the capability of editing three files simultaneously. You can customize the editor without getting into the source code: The install program lets you choose such characteristics as placement of the arrow key.

Workman says FTL conforms to the standard in the third edition of Niklaus Wirth's *Programming in Modula-2*.

FTL requires CP/M 2.2, 3.0, or later; a Z80; at least a 58K-byte transient program area; and one disk drive. Workman will supply the compiler on any of 190 CP/M disk formats.

For \$49.95, you get the compiler, linker, editor, assembler, library modules, library source code, manual,

and telephone support. Source code for the editor costs \$39.95. Or you can buy it all for \$79.95. Workman asks for no royalties on programs written in FTL. Contact Workman and Associates, 112 Marion Ave., Pasadena, CA 91106, (818) 796-4401. Inquiry 577.

Modula-2 In Source Form

Modula-2 fans can now get the latest version of the compiler in source form. Modula Corporation says the new compiler, written by Niklaus Wirth, is faster because it's based on the single-pass principle. It can recompile itself in 80 seconds on a Lilith workstation, the company says.

The package includes the source to the compiler and a portable debugger in IBM PC or Lilith format, a copy of the third edition of Wirth's *Programming in Modula-2*, and technical reports on the structure of the compiler and debugger. The compiler consists of about 5000 lines of Modula-2 code.

Three versions are available: for the Lilith, the Motorola 68000 family, and the National Semiconductor 32000 family. The Lilith version produces M-code, a symmetric machine language for a pure stack computer. The other two versions have been derived from the M-code version.

Modula has ported the compiler to the IBM PC and the Macintosh.

The price for each compiler in source form is \$1000. Contact Modula Corp., 950 North University Ave., Provo, UT 84604, (800) 545-4842 or (801) 375-7400. Inquiry 578.

Multitasking OS for Atari ST

Micro RTX is a multitasking operating system kernel for the Atari ST series. Because it's compatible with TOS, it can run regular ST programs. The system automatically handles input, output, and memory management in a multitasking environment. Programs can make standard TOS calls to perform I/O and memory management.

Once you've installed the operating system, the ST becomes a multitasking machine in which all activities are performed by processes running under Micro RTX. The number of active processes is limited only by available memory. The system uses round-robin scheduling to keep a process from consuming too much CPU time.

Micro RTX is priced at \$69.95. Contact Beckemeyer Development Tools, 592 Jean St. #304, Oakland, CA 94610, (415) 658-5318. Inquiry 579.

Library for C Programmers

PforCe, a library package for programming in C, offers high-level functions for manipulating windows, screens of fields, and databases as objects. The object-oriented approach is designed to facilitate maintenance of modules and also to help you program in a structured style. Among the package's subsystems for handling complicated tasks are a database system with demand paging and B-trees to store access and index information; a windowing system; interrupt-driven communications; and background tasks. Source code is supplied for all functions and bundled utilities. PforCe runs under MS-

and PC-DOS and can be used with Microsoft, Lattice, Computer Innovations, and Wizard compilers. It supports all memory modules of each compiler. The library costs \$395. Contact Phoenix Computer Products Corp., 320 Norwood Park S., Norwood, MA 02062, (617) 762-5030. Inquiry 580.

FORTRAN Utilities

FORTRAN Cross-Reference Utility, from PJN International, reads source files written in FORTRAN 77 and generates a program listing with symbol cross-reference maps of variables, subprogram calls, and labels for each subprogram. PJN says its software generates cross-reference maps with the same detail provided by mainframe compilers; for example, the variable cross-reference map also shows variable type, length, allocation (array/scalar), and scope (local/common).

FORTRAN Utility Library is a collection of assembly language subroutines that can give programs such capabilities as screen and cursor manipulation, direct keyboard access, command-line access, memory peek and poke, and sound generation. There's a version for Microsoft/IBM FORTRAN and one for Ryan-McFarland/IBM Professional FORTRAN compilers.

Both utilities run on IBM PCs and compatibles under DOS 2.0 or later. The cross-reference package requires 128K bytes. Cross-Reference Utility costs \$49.95. Utility Library costs \$39.95. (For each, add \$2 for shipping.) Contact PJN International, POB 201363, Austin, TX 78720-1363, (512) 837-2888. Inquiry 581.

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SOFTWARE • BUSINESS AND OTHER

**MIDI Studio
for Amiga**

SoundScape software combines MIDI, sampling, and multitrack recording on an Amiga computer. Mimetics says its program is actually an operating system that resides simultaneously with the Amiga's DOS and Workbench.

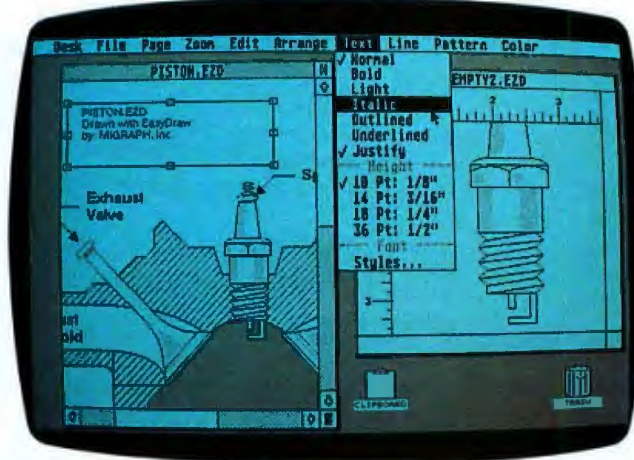
The main program consists of a multitrack music sequencer with an unlimited number of MIDI-compatible tracks. You can put each track in play, record, mute, thru, or "match" mode (Match mode can be used to learn or practice a piece of music; it stops playback until you've played the notes in the selected track.) A time-oriented editing system lets you cut and paste using a mouse.

SoundScape works with keyboards plugged into the second game port, the internal sound synthesizer, MIDI I/O, pitch followers, and the computer's keyboard. It costs \$149. Contact Mimetics, 16360 Stevens Canyon Rd., Cupertino, CA 95014, (408) 741-0117. Inquiry 587.

**Object-oriented
Drawing Program Runs
on Atari ST**

Easy-Draw, an object-oriented art program for the Atari ST, can be used to create business and presentation graphics, line drawings, and multiple-layer illustrations. The package lets you move and manipulate objects, copy them, rotate them, and stretch and size them. You can zoom in on any area, pick from predefined patterns, use shadowing, and use rules and grids.

The program provides two windows for working in. You can move and copy draw-



Easy-Draw, an object-oriented program for the Atari ST.

ings between windows. Easy-Draw uses high-resolution output for printing.

The software runs on a color or monochrome ST. Suggested retail price is \$149.95. Contact Migraph Inc., 720 South 333rd St. Suite 201, Federal Way, WA 98003, (206) 838-4677. Inquiry 588.

**Music Plotter
for Apples**

Personal Music Engraver, described by developer Newgo Inc. as a professional music calligraphy program, automates the process of putting music to paper. The software, which works with an x, y plotter to produce music characters, runs on the Apple II+, IIc, and IIe.

Newgo says the program works like a word processor. It is smart enough to check

your "musical grammar" while you type, and it automatically displays notes with the correct stem length and direction. The editor lets you change, delete, or insert measures anywhere in any part. The package also lets you transpose notes, control page format (including spacing between staves and number of staves per page), set horizontal spacing, and use 10 font sizes. Personal Music Engraver can print complete scores (with an upgrade), lead sheets, charts, exercises, and templates with blank measures.

The program requires an XY plotter with DMPL-IV language (for example, the Houston Instrument PC-695 or DMP-29). Personal Music Engraver sells for \$1395; the upgrade that lets it produce complete scores costs \$29.95. Contact Music Graphics Inc., POB 22,

Winchester, VA 22601-0022. (703) 665-0239. Inquiry 589.

**Mail Program
for LANs Features
Multimedia Messages**

PCC/Systems has released cc:Mail for local-area networks of IBM PCs and compatibles. The software lets you write, store, send, and receive electronic messages that can consist of anything you can create with your microcomputer, including text, graphics, and data files. The program has a word processor and a graphics package, and it's capable of capturing screens from application programs; you can then edit these snapshots and insert them in your messages. Each message can combine as many as 20 text, graphics, and file items.

It takes one keystroke to send mail. You can request a receipt telling you when the recipient got the message. You can store mail in up to 100 personal folders, each of which can hold 500 messages. Mail can be exchanged between cc:Mail systems on dissimilar LANs. The software is designed to operate on networks with single or multiple file servers. Communications use X-PC error correction. All database files are encrypted.

The software runs under DOS 2.0 or later on IBM PCs and compatibles with at least 320K bytes of RAM and a Hayes or compatible modem. A 10-user starter version of cc:Mail for LANs costs \$995. Contact PCC/Systems, 480 California Ave., Suite 201, Palo Alto, CA 94306, (415) 321-0430. Inquiry 590. ■

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

R·E·V·I·E·W·E·R'S N·O·T·E·B·O·O·K

There were many interesting products at the West Coast Computer Faire in San Francisco. Without a doubt, the most intriguing was David Small's MacCartridge, a cartridge-disk combination that allows 1-megabyte Atari STs to run Macintosh software faster, without modification, and using Atari's excellent and larger monochrome monitor. The product is real, but it may never be marketed, because Apple must approve its use of the Macintosh ROM. Still, I had to suppress a chuckle at the thought of using MacCartridge to run Meacom's Apple II emulator.

Speaking of which, I was also impressed with Mimic Inc.'s Spartan, an Apple II+ emulator for the Commodore 64. The \$299 unit includes eight standard Apple-compatible peripheral slots, and it runs DOS 3.3, Applesoft, Integer BASIC, Apple Pascal, and CP/M (with a Z80 card). A DOS card allows your 1541 drive to read both Apple and Commodore disks and, because the emulators have their own CPU and two video outlets, you can run both Commodore and Apple software at the same time (to different monitors, of course).

There are yet more peripherals for both the Amiga and the ST. Micro Forge showed a seven-slot expansion box for the Amiga. The system can hold two 10- to 40-megabyte hard disk drives and comes with a 130-watt power supply. Developers in need of RAM disks and workspaces for use with audio and video digitizers may also appreciate Comspec's \$1079 2-megabyte memory board, which comes with a pre-installed RAM test.

For the ST, Supra is now supplying 10- and 20-megabyte hard drives, the latter at the Faire for \$799. The display unit at the Faire impressively flashed 32K-byte Neochrome images on a color monitor. Finally, LogiKhron

has perhaps the first cartridge utility for the ST, a \$50 clock card with an internal battery that automatically loads the date and time into the ST when you boot.

Two applications stand out. For the Amiga, there is Aegis's Animator, which is bundled with their Images. The Animator, a color animation tool, allows you to create 32-color objects, animate them, and create storyboards with backdrops from Images. You can alter the position, shape, size, and color of objects and rotate them or plot their path around the screen.

For the ST, there is Migraph's Easy Draw, a "professional drawing program" that requires TOS in ROM. The list of features is very impressive. In addition to conventional capabilities, you can adjust the size of the drawing surface, add shadows, and use wedges and arcs. The software can support many professional needs, from the creation of floor plans to the presentation of intricate three-dimensional shapes.

There were yet more IBM PC AT clones and at ever-decreasing prices. The Ceptre PC-galaxy is a \$1995 AT compatible with eight slots (three of which are PC-compatible), a 6-MHz clock upgradable to 8 MHz, a 1.2-megabyte drive, and a 195-watt power supply. The Cranium 286/10 AT clone costs \$3050, which includes a 235-watt power supply, 12 slots, 6-MHz or 10-MHz clock speed, and a 31-megabyte hard disk drive.

For IBM users, there is Software Carousel from SoftLogic Solutions, a \$50 utility that accesses extended memory, allowing you to run up to 10 programs, each at the touch of a key. Every program can use all available system RAM because the software employs a virtual memory manager that can use lower RAM, AT extended RAM, "above board" RAM, or even

disk space as a reservoir. And by establishing the amount of RAM each program will use, you can switch immediately among applications, pausing one while running the next.

And, for the PC, there is Finally!, a subroutine library for compiled BASIC from Komputerwerk that contains over 100 utilities that you can include in your source code or link to your object code at run time. The utilities include a variety of general and geometrical mathematical functions, file and directory control, medium- and high-resolution graphics, hardware interfacing, number conversions, keyboard, printer and screen control, string handling, and sorting routines.

Lest Macintosh users feel slighted, I have enjoyed Affinity's Tempo, version 1.1, a macro facility that allows you to record and later replay keystrokes and mouse clicks. There are some special features. For example, you can make the playback of a macro conditional upon text in a document or the value of a spreadsheet cell. Macros are indispensable for carrying out repetitive tasks, but you will also enjoy automatically opening applications from the Finder and including dialog boxes within your macros. Unlike many macro facilities on the IBM PC, macros will only play back within the application in which you created them. You can suspend them by simply holding down the mouse button and even edit them during the pause.

And the reviews business goes on. We are organizing a joint review of new Modula-2 compilers for the Atari ST, Macintosh, and IBM PC. A Laser 128 is en route to a reviewer, and we are preparing in-house the formal review of the Amiga.

—Jon Edwards
Technical Editor, Reviews



THE ATARI 520ST

BY ERIC JENSEN

The Atari 520ST is a very appealing machine. It is a good engine for bit-mapped graphics, with a good user interface and an attractive price. Still, the review machine had too many rough edges to serve as my primary machine. It is far from portable. A two-drive system put seven boxes on my tabletop and required four wall outlets.

The processor and each disk drive have separate power supplies and the four power switches are inconvenient. I don't like leaving the power supply plugged in while its output is turned off. It draws some power, and I worry that the system will be susceptible to power-line glitches even while turned off. The practical solution seems to be to use a switched outlet box.

HARDWARE

The hardware appears clean. The 8-MHz clock rate (a bit faster than either Macintosh's or Amiga's) probably translates to about half a million typical instructions per second. There is no other special display support hardware, and none is needed for windowing applications. The display appears to be properly interleaved with the processor so that they do not have to wait for each other. The display generator is an interesting compromise. For the monochrome display, it fetches a word of data and shifts it out a bit at a time to determine the color for 16 successive pixels. For the color displays, it fetches either two or four words in sequence and shifts out a bit of each to develop a color lookup-table index. Again, there are 16 shift cycles before the

A good engine for bit-mapped graphics at an attractive price



next words must be fetched. Thus you have neither the situation in which all the bits describing one pixel are in one word, nor that in which the most significant bits for all pixels are contiguous in memory.

As long as this arrangement is hidden under GEM—as it should be for almost all users—this is fine, but there are a couple of cases in which it could be inconvenient. If you were to use multiple planes of memory (with a degenerate color map) to represent multiple overlaid images, then the images would be inconveniently intertwined. If you have to mask out an irregular region in a picture, then you have to know not only the number of words in a scan line but also the spacing between words, which may not be the same in the image and the mask.

The 512K bytes of RAM is enough for most programming, although the operating system for the reviewed machine used more than 200K. [Editor's note: The latest production units for the 520ST and 1040ST have TOS in ROM.] In addition, the screen uses at least 32K more.

The displays are very crisp and clean, with enough resolution to draw pictures of good quality. The 12-inch screens provide almost twice the area of the 9-inch Macintosh screen. The SM124 monochrome monitor provides a 640- by 400-pixel display. This allows 22 lines of 110 characters in the directory font, or 20 lines of 77 in the standard font used in BASIC windows (allowing window borders), which is enough to do a fair job of emulating a dumb terminal.

There are about 77 dots to the inch horizontally by 65 vertically, which is fine enough resolution to make the jagged edges of diagonal lines fairly unobtrusive.

You can run the SC1224 color monitor in two modes (640 by 200 pixels with 4 colors or 320 by 200 pixels with 16 colors). The lower resolution mode is the operating system's initial choice. This keeps the aspect ratio of icons the same as on the monochrome monitor and simply doubles their sizes. The jagged edges are noticeable here but not particularly offensive. I was very impressed by the lack of colored "shadow" edges on

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Eric Jensen (50 Carriage Lane, Bedford, NH 03102) is a programmer for Hasteck Inc. His interests include artificial intelligence, math and logic, and displays.

Windows are not erased as neatly as they might be—you often see that every underlying window gets a "please clean up" signal.

window borders and characters. Another plus is that you can work in black and white on this color monitor without eyestrain.

The disk drives use 356K-byte 3½-inch floppy disks. They seem reliable, but I had several problems. First, the cables are so short that most users will choose to put the drives to the left of the keyboard. If you try to put them on the right, they will block the mouse connector or sit at an uncomfortable angle. Second, you can press the eject button to remove disks, but the manuals do not explain whether it is safe to reset the machine or power down without first ejecting the disk. The eject button was also a bit inconsistent—crisp one time and mushy the next. Finally, the documentation does not explain that, in a two-drive system, the drive closer to the processor automatically becomes drive A. There are no switches to set or jumpers to connect. There is also no comment indicating that you cannot daisy-chain a third drive.

The two-button mouse has a good feel. You can remove the ball for cleaning, which is a nice feature not present on some professional workstations. However, I had one problem: I found double-clicking the buttons to be very difficult, even after adjusting the delay with the control panel. Perhaps Atari should be measuring up-to-down transition time rather than down-to-down. Perhaps button debouncing logic gets in the way.

Finally, the keyboard has about the same key feel (and exactly the same key spacing) as the Digital keyboard I use every day, so I like it. The oddest feature of the keyboard is the rhom-

boid shape of the function keys, which are almost impossible to hit without hitting their neighbors.

GEM

GEM appears to be a solid product, with a few excesses and inconveniences, but pretty well on target for anything short of animation. It includes calls equivalent to most of the Graphics Kernel System (GKS) used in many standard graphics programs, but it may be weak in the area of partially redrawn pictures.

Windows are not erased as neatly as they might be—you can often see that every underlying window gets a "please clean up" signal. And after clicking the mouse on any of the window-change bars, the cursor was not redisplayed until the mouse was moved. One of the few bugs I encountered here was a requirement that a window be retitled after it is moved. It seemed to acquire a new name on its first movement but not thereafter.

Atari's TOS, on the other hand, has a number of holes. I haven't documented any crashes. (It appears that memory may not completely recover when you change disks, leading to eventually running out of storage, but I haven't proved it. If so, it takes quite a few disk changes to run out of space.) I have, however, stumbled over a fairly steady stream of minor nuisances and cosmetic inconveniences. Exiting from a program back to the operating system, for example, does not reinitialize the color map; if, therefore, a program changes the colors to black and white, you might get back to the desktop and not see anything. Selecting textual instead of icon directory displays and then changing from low resolution to medium resolution leaves both icon and textual formats selected for the next directory display (and picks icon).

As a whole, though, TOS is a reasonable operating system. It provides a file system that looks almost identical to that in MS-DOS, with directories and subdirectories (called "folders" in the desktop idiom) and files with date and time stamp. (This latter feature is less useful than it should be because the clock resets with the processor,

and it is easy to forget about it.)

The desktop command interface does a pretty good job of providing most of the commands possible with MS-DOS. My MS-DOS manual lists 31 commands. Fourteen translate directly, eight are simply calls to standard utility programs (two of which are provided here), six make no sense in translation (such as setting the prompt on the command line), and the last three are more difficult. Renaming a file requires selecting the file, getting a menu of "File Info;" and overtyping the filename in the menu. Defining environment variables and creating batch jobs seem impossible, and commands that take arguments are a bit inconvenient. (The developer's package includes most of the missing utilities and a textual command interface that looks a lot like MS-DOS.)

The desktop is clearly much simpler than that provided with the Macintosh. Most of the basics are there, but, for example, there is no choice of font or type size from the main menu bar.

ATARI BASIC

The only languages that come bundled with the machine are Logo and BASIC. The BASIC on the review machine is modern, flashy, and huge. It will be more usable with the operating system in ROM, but with TOS in RAM, I had to disable graphics buffering and dimension the array as an integer array in order to use an array of 7000 elements. Still, Atari BASIC was considerably more than the minimal textbook language. It performed the BYTE computational benchmarks about twice as fast as an IBM PC, while apparently accumulating fewer floating-point errors, and it moved files about a third as fast.

The most obvious feature of the BASIC is its use of four windows—a command window at the bottom, a listing window at the upper left, an output window at the upper right, and an edit window pushed behind all of the above. Atari BASIC is smart enough to fill the screen on either the monochrome or the color monitor—a feature missing on the TOS desktop. There is an inconvenience here,

(continued)

AT A GLANCE

Name

Atari 520ST

Company

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Components

Processor: Motorola 68000

Memory: 512K bytes of dynamic RAM

Display: 12-inch monochrome or color

Graphics: Three modes, 640-by 400-pixel monochrome, 320 by 200 with 16 colors, and 640 by 200 with 4 colors
Keyboard: 94-key Selectric-style QWERTY keyboard with numeric keypad, cursor controls, and rhomboid function keys

Sound: Three independent sound channels from 30 Hz to 125 kHz

Floppy disk drive: Bundled, external 3½-inch single-sided double-density drive with capacity of 360K bytes; system supports maximum of two floppy disk drives

Interfaces

MIDI-in and MIDI-out ports

Monitor port (supports RGB analog, high-resolution monochrome)

Centronics parallel printer port (supports Epson-compatible printers)

RS-232C serial port

Floppy disk port

Hard disk port (10-megabit-per-second DMA transfer rate)

128K-byte ROM cartridge port

Ports for mouse or two joysticks

Bundled Software

Atari Logo, Atari BASIC

Optional Peripherals

SF354 single-sided drive \$199

SF314 double-sided drive \$299

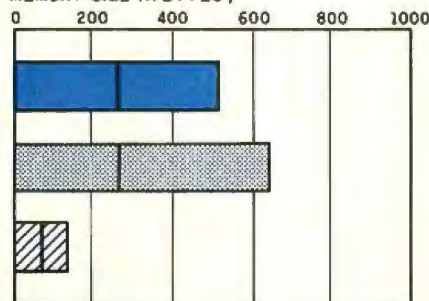
Price

Monochrome system \$799

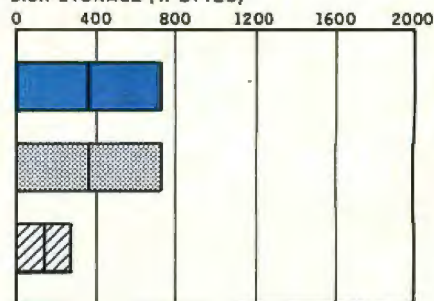
Color system \$999



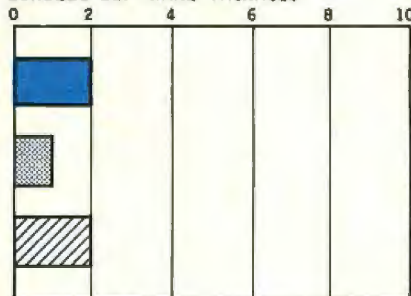
MEMORY SIZE (K BYTES)



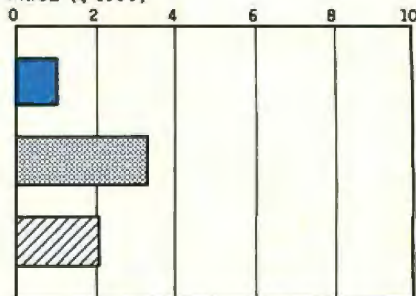
DISK STORAGE (K BYTES)



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■ ATARI 520ST

■ IBM PC

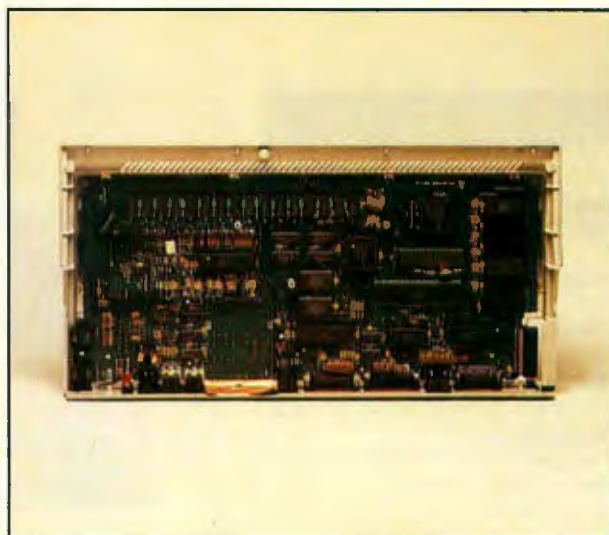
■ APPLE IIe

The Memory Size graph shows the standard and optional memory available for the computers under comparison. The Disk Storage graph shows the highest capacity for a single floppy disk drive and the maximum standard capacity for each system. The Bundled Software Packages graph shows the number of software packages included with each system. The Price graph shows the list price of a system

configured with two disk drives, a monochrome monitor with connection apparatus, a printer port and serial port, 256K bytes of memory (64K bytes for 8-bit systems), the standard operating system for the computers under comparison, and the standard BASIC interpreter. Note that the price of the Atari 520ST includes 512K bytes of memory and a second single-sided drive.

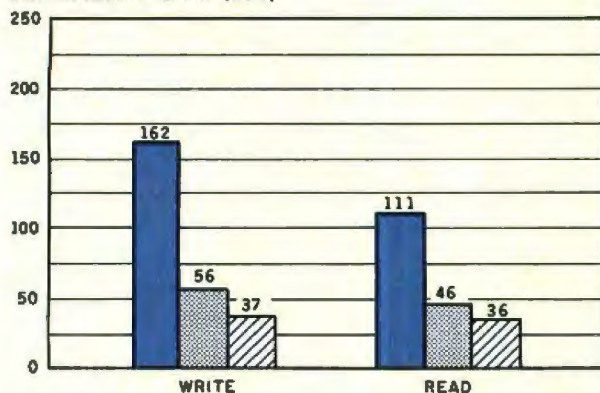


The ST ports include MIDI in and MIDI out, a Centronics parallel printer port, an RS-232C serial port, and a DMA port.

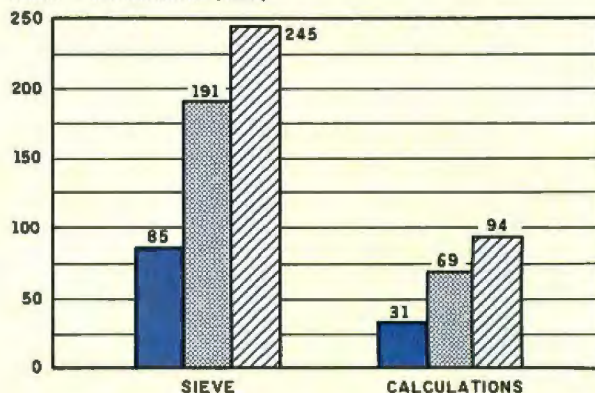


Inside the Atari 520ST.

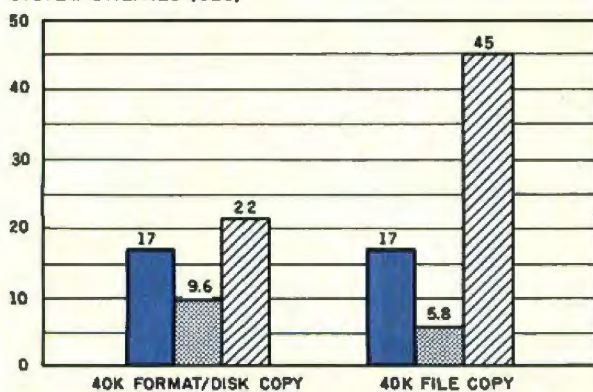
DISK ACCESS IN BASIC (SEC)



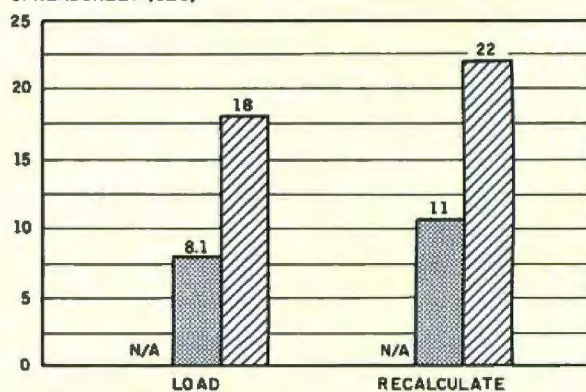
BASIC PERFORMANCE (SEC)



SYSTEM UTILITIES (SEC)



SPREADSHEET (SEC)



■ ATARI 520ST ■ IBM PC ■ APPLE II

The graphs for Disk Access in BASIC show how long it takes to write and then read a 64K-byte sequential text file to a blank floppy disk. (For the program listings see *BYTE's Inside the IBM PCs*, Fall 1985, page 195.) The Sieve graph shows how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. The Calculations graph shows how long it takes to do 10,000 multiplication and 10,000 division operations using single-precision numbers.

The System Utilities graphs show how long it takes to format and copy a 40K-byte file using the system utilities. The Spreadsheet graph shows how long it takes to load and recalculate a 25- by 25-cell spreadsheet in which each cell equals 1.001 times the cell to its left. Tests for the Atari 520ST were done using TOS and Atari BASIC. Running the Sieve on the Atari required that we dimension the array as an integer array.

The developer's package includes a C compiler, linker, and debugger, and the glue to hold them together.

though. The BASIC automatically wraps text to the next line after 80 characters, but a color window line holds only 38, and monochrome 77, so you can never see all of a long line without panning. All the normal window controls are available, so each window can be repositioned, resized, or even closed. You will soon discover the convenience of being able to keep an old listing on the screen in one window while you type modifications into another.

The editing features are woefully short of general word processing. You can move the cursor (with the cursor keys but not the mouse) and overtype characters fairly easily, but inserting new characters requires cursor positioning with the cursor keys, menu selection with the mouse, and finally the insert from the keyboard.

Perhaps the most useful extension of this BASIC is its ability to call a large number of the standard GEM display functions. For example, you can draw graphs and pictures from BASIC without resorting to obscure hieroglyphics or pokes. Other modern constructs include named subroutines and WHILE.

The developer's package includes a C compiler, linker, and debugger, and the glue to hold them together. There is an adequate editor. It took me about 8 minutes to get around the edit-compile-link-run loop, with a surprisingly large portion of that time spent in the linker searching the ex-

tensive GEM libraries. The compiler used the standard three passes and passed its output to an assembler, resulting in at least four trips through files. The linker took almost as long. Note in the benchmark graphs that disk I/O is about three times as slow as on the IBM PC; a hard disk would help considerably.

CONCLUSION

The Atari 520ST is a very appealing system in need of some further software development. The user interface is easy to learn and use, and the system is powerful enough for serious work. The developer's package appears to offer enough tools and access to the system internals to suggest that software will get written. The computer brings the convenience and naturalness of the "desktop metaphor" down to a lower price bracket, and thus a larger audience. It has a good chance of becoming a very popular machine. ■

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STORAGE FOR THE MASSES

BY BRUCE WEBSTER

An industry update, and Bruce also looks at some storage devices

I'm writing this column in the last half of February, and the industry seems to be largely catching its breath after the Christmas season and the January trade shows. I'm doing a little breath-catching myself, after juggling different languages, compilers, and machines for last month's column. Once again, it's time to pause from the 68000 wars and look at a few of the products that have shown up over the past few months.

INDUSTRY UPDATE

Apple, much to its dealers' surprise and delight, has wasted little time shipping the Macintosh Plus in significant numbers. No indication yet as to how the Mac Plus is selling with its hefty \$2600 price tag; I would suspect that dealers are having little trouble selling what they can get, though. In the meantime, some interesting rumors about the Apple IIx (next generation of the Apple II line) continue to surface. Over on BIX, one alleged description was posted that made the IIx appear to leapfrog the Amiga and the Atari ST machines: 4-megahertz 65C816 processor (which has a 16-megabyte address space and a 6502 emulation mode), Mac-equivalent ROMs, 4096 colors, high-resolution display, 32-voice sound synthesizer, 1 megabyte of RAM (expandable to multiple megabytes), Apple II and Macintosh emulation modes, and an affordable price tag (less than \$1500).

That rumor is wild enough to just possibly be true, especially if Steve Wozniak is indeed involved in the machine's design. Woz knows what hackers and developers want and—more important—knows that hackers and developers are the ones who write all the software that sells the machines. Rather than deliver a closed, crippled machine like the original 128K-byte Macintosh, which has gone through two generations in two years, Woz and Apple together just might have the brains and vision to put together a machine that can survive through the next ten years, just as the original Apple II has survived the last ten.

Atari, in the meantime, is having delays in shipping the 1040ST and the new 520ST. The word from Atari is "any minute now," and I suspect its people are working very hard to meet that, lest they fall victim to the famed Osborne syndrome. For those of you unfamiliar with microcomputer history, the Osborne 1 was a marketing innovation: a cheap, portable CP/M computer with lots of bundled software. Unfortunately, it had a number of limita-

tions, like a tiny screen (5 inches) that displayed only 52 characters on a line and disk drives that didn't hold a whole lot (90K bytes). Osborne, feeling the heat of competition from Kaypro (which had entered the mar-

ket with a similar but better system), announced the Osborne Executive, which corrected most of the problems of the Osborne 1. Unfortunately, production problems prevented Osborne from shipping the Executive for a few months, and sales of the Osborne 1 dropped to almost zero as dealers and customers waited for the new, improved version. Osborne was already on shaky financial ground, and that turned out to be the coup de grace, pushing Osborne into Chapter 11 financial reorganization (i.e., bankruptcy). Osborne emerged from bankruptcy a year or two ago but hasn't been able to make any significant market penetration.

So why would the people at Atari announce the 1040ST and the new 520ST before they could ship them? A combination of reasons, probably. Conflicting reports continue to come in on how the Amiga and the 520ST did during the Christmas season, but most sources indicate that the Amiga outsold the 520ST. Whatever the actual numbers, the 520ST was not the runaway success that many (including myself) thought it would be. That, combined with Apple's pending announcement of the Mac Plus and the lack of a good trade show forum during the spring, probably enticed Atari to make the announcement at the Winter Consumer Electronics Show in early January, even though they weren't ready to ship yet. At that time, they were saying "end of January," which was a reasonable and acceptable delay. Unfortunately, it's now late February, significant editorial coverage of the 1040ST has been appearing for a month now—with more to come—and the machines still haven't been shipped. I'll wager that 520ST sales have dropped off sharply, partly because of the announcements and partly because inventories of the "old" 520ST have been exhausted and Atari is (very understandably) unwilling or unable to produce more "old" units.

It would be a shame to see Atari hurt by this delay, especially since the 1040ST and the revised 520ST possibly represent the best price/performance deals in the history of microcomputers. Atari is probably better able to sur-

(continued)

Bruce Webster is a consulting editor for BYTE. He can be contacted c/o BYTE, POB 1910, Orem, UT 84057, or on BIX as bwebster.

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vive the sudden drop in sales than Osborne was, but they need to get those machines out the door soon; no company can survive dramatically reduced sales for long . . . except, possibly, IBM, which reputedly has a few billion dollars in the bank.

Commodore, in the meantime, seems to keep dodging the bullet that everyone thought would have been fatal by now. The bankers are apparently convinced that a live but ailing Commodore stands a better chance of paying off its debts than a dead one and that sales of the C-64, C-128, and Amiga are sufficient to keep Commodore alive for now. Smart folks, those bankers. The two big problems still appear to be lack of software and Commodore itself. Little new software has shown up in the past month, though a number of companies (like Aegis) claim to be on the verge of shipping several titles, and I still don't know if a decent word processor is available for the Amiga—especially critical because of Commodore's attempts to position the Amiga as a business machine.

Commodore seems to be hurting its own cause by throwing up roadblocks for developers. The latest obstacle: Commodore apparently wants software firms to pay \$500/product/year for the privilege of putting the Workbench (desktop interface) on their product disks. This strikes me as unnecessary and counterproductive, since every Amiga owner already has the Workbench. Developers can, of course, not put that stuff on their disks and just have the users make working copies, like most CP/M and MS-DOS software, but it is in both Commodore's and the developers' interest to make things as easy as possible.

IBM, as always, goes right along being IBM, comfortable in its view of the marketplace and its position therein. The question is how closely that view corresponds to reality, since the clone makers continue to eat away at IBM's market share. On the other hand, the real question might be whether or not it matters, since for large sections of the computer market, IBM has the apparent power to define just what reality is, with hordes of analysts and MIS managers following in its wake. Still, it was Zenith's portable, not the much-rumored (and still unannounced) IBM laptop computer, that won the key IRS contract. And the large inventories of unsold IBM PCs and XT's appear to be keeping IBM from introducing any new PC systems. Big Blue may just have painted itself into a corner.

PRODUCT OF THE MONTH: MACBOTTOM

To be honest, I was hesitant about picking the MacBottom 20-megabyte hard disk as product of the month. I'm sure there are Macintosh hard disks that are newer, or cheaper, or faster, or have more sophisticated system software. And there isn't much about it that's flashy or exciting. In fact, in the few months I've had it, I've given very little thought to it. Ironically, that's exactly why I did pick it as product of the month: because, day after day, week after week, it has quietly, unobtrusively done its job and done it very well. No crashes. No bugs. No lost files. No lost desk space. No power switches to fiddle with. Easy boot-up. Nice utilities. Fast performance. In short, just

(continued)

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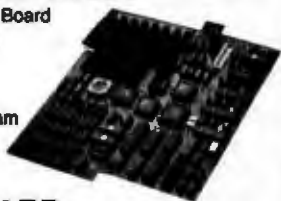
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or Images from the Workbench, if you change directory, you must change directory back to "sys:" or the Workbench will crash when you exit. CLI is fine. I'm not sure if I will be able to fix this bug as it appears to be in the Workbench. See topics "software" and "flames" for more discussion of this problem.

In the meantime I would really suggest for this and many other reasons that you get rid of the Workbench and run things from the not-as-pretty but far more reliable CLI. There is a batch file "noworkbench" included on the Animator disk that when run should keep Workbench from appearing when you reboot.

amiga/product.dcsn #686, from jdow
a comment to 685

Rather than having the program automatically relog to "sys:" the more proper route is to note where it is when your program starts and relog to that. Somehow, I agree with you. A well-behaved program should not have any effect on the underlying system parameters after it exits unless it is something like CD, which must have that effect because of its function.

(CP/M is something like that—a program can log new "drives" and "users" all it wants. The only way it affects the CLI environment is to change the value at location 4. Well-behaved programs leave this alone unless appropriate.)

amiga/product.dcsn #687, from jim_kent
a comment to 686

Well, anyway, got my CD back to work. Bug fixed in 1.10 release of Animator.

ATARI ST

This month's discussions include answers concerning Atari ST graphics and programming languages. Once again, the problem of resolution switching is addressed, and several conference members have made considerable progress in solving the problem. Also, a few helpful hints in graphics programming are offered. But the debate over which language to use rages on, as conference members discuss the pros and cons of Modula-2, C, and Pascal.

GRAPHICS COPROCESSOR

atari.st/main #28, from dbetz [David Betz, Senior Editor, BIX]

Are the 1040STs being delivered with the sockets for the enhanced graphics chip?

atari.st/main #29, from neilharris [Neil Harris, Atari Corp.]
a comment to 28

According to Sam Tramiel, the graphics chip is not intended for the 1040ST. It will go into a future product in the ST line, at a higher price point than the current model. However, the graphics coprocessor will be available as an upgrade board for the current models.

atari.st/main #30, from ruley [John Ruley, University of Dayton]
a comment to 29

Whoa! That is directly opposed to what we've been hearing here and in the BYTE article [March 1986]—are you sure you mean that?

If it is a board-level operation, then is there going to be an upgrade for the 520ST as well? You could make a lot of friends that way!

atari.st/main #36, from neilharris
a comment to 30

Coprocessor Upgrade

If you read the BYTE article carefully, you will see that the interview [with Shiraz Shivji] mentions a possible socket, not a definite one. There is no socket in the production 1040ST. The official Atari response on the coprocessor upgrade board is that it will be available for the 1040ST.

atari.st/main #40, from cheath [Charlie Heath, MicroSmiths Inc.]
a comment to 36

How does one access the coprocessor? Is it a switch in ROMs, and do the ROM calls use the coprocessor instead of the CPU? Is the software ready? Does the coprocessor give any new video output modes, or is it just a fast memory mover and line drawer?

atari.st/main #41, from neilharris
a comment to 40

The coprocessor requires a new set of ROMs, currently under development. All system calls are identical, but some work faster. The extra functions will be accessible through the BIOS. In addition to the blit functions, the chip will handle halftoning and horizontal and vertical line drawing.

atari.st/main #43, from jim_kent [Jim Kent]
a comment to 41

So it looks like no lines and much less fills. I assumed the blitter would pick up on the unused instruction trap that now calls the a-line. Oh well. We are still going to get some blazing graphics on this beast if we have to code it in 68000 ourselves.

atari.st/main #59, from philemon [Philip Lemmons, Editor in Chief, BYTE]
a comment to 29

In Hannover, I spoke to Shiraz Shivji, the principal 1040 designer. He said future 1040s will have the socket for the graphics coprocessor. He also promised us an article on how the coprocessor works.

atari.st/questions #15, from dnorton [Duane Norton]

Could someone in the know give us all some hard information on the capabilities of the graphics coprocessor which may or may not be on the 1040ST? Is it just a boundary-oriented blitter, capable of moving arbitrary blocks of memory from here to there, or will it be more like a NEC 7220, with line-drawing primitives and its own op codes?

atari.st/questions #19, from neilharris
a comment to 15

The graphics coprocessor is primarily a blitter, with the usual complement of move functions with Boolean operators. It is also capable of halftoning during the blit. Horizontal and vertical line drawing are included (actually, these are subsets of a blit anyway—rectangles with a width or height of 1). Graphics operations are between two and ten times faster with this chip. We expect this to be most noticeable in the day-to-day text operations (including scrolling) as well as graphics animation.

atari.st/questions #20, from dnorton
a comment to 19

Many thanks for the information, Neil. Hmmmm... so is this new chip a truly general memory-to-memory DMA device? On a bit, not word, boundary? Sounds like it could be used for more than graphics, such

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RESOLUTION SWITCHING

atari.st/tech #23, from swestrup [Stirling Westrup, Xuclid Research]

According to previous messages in the technical section of the old Atari conference (see April BYTE, page 367), you can change from low to medium resolution without rebooting if you poke the desired screen resolution into the hardware register ShiftMd. What is the address of this register? The only reference I could find to it was in the *Hitchhiker's Guide to the BIOS*, where they say that it is shadowed by SShiftMd at location \$44C.

atari.st/tech #25, from [tuermer [Joerg Tuermer]
a comment to 23

The address of ShiftMd is \$FF8260. I have no color monitor, so I can make no tests, but the XBIOS function 5 (`__SetScreen`) also mentioned in the *Hitchhiker's Guide* should do the changing without booting. Changing by direct setting of ShiftMd may leave the machine with some problems concerning cursor, fonts, etc.

atari.st/tech #55, from swestrup
a comment to 25

Of course `__SetScreen` should change resolution without rebooting, but it doesn't! And here I am wanting to change resolution while booting. That's so programs in the Auto directory come up in the right resolution.

atari.st/main #39, from cheatw

We asked Digital Research Inc. if it was possible under software control to even switch from 320- by 200-pixel, 16-color resolution to 640 by 200 resolution so we could present 80-column text and then switch to a multicolor graphics display. The folks at DRI told us we'd have to reboot.

atari.st/main #44, from swestrup
a comment to 39

I have now successfully switched the Atari from low to medium resolution and back again without crashing the system or rebooting. My current problem is that GEM still thinks it's in the wrong mode and all of the fonts and windows are garbled. I tried poking the correct resolution into SShiftMd, but that didn't work.

atari.st/tech #70, from swestrup

I am uploading a listing of a 68000 assembler program that switches the Atari ST into medium-resolution mode without going through BIOS or XBIOS. It can be assembled and linked with the standard DRI assembler and linker that come with the developer's package. I have no idea what this program will do to a monochrome monitor. Are there any brave souls out there?

atari.st/listings #5, from swestrup

FIXSCR.S

I wrote this test program to change the screen resolution from low to medium without having to reboot the system. This program has to operate in supervisor mode so that the hardware register ShiftMd (\$FF8260) can be set. The value \$F9 corresponds to Medium Res, while \$F8 is Low Res. Unfortunately, GEM does not recognize the change and behaves as if the old resolution is still in effect. In addition, this program will occasionally cause a few bombs to appear on the screen. I don't know why.

```
.TEXT
MOVE.L #0, -(A7)    * PUSH A REQUEST FOR
MOVE.W #320, -(A7)  * SUPERVISOR STATUS
TRAP #1             * AND TRAP FOR IT
ADDQ.L #6,A7        * THEN FIX UP THE STACK

MOVE SR,D0          * READ THE STATUS REGISTER
MOVE.B #F9,$FF8260 * GO TO MEDIUM RES MODE

AND #DFFF,D0        * CLEAR THE SUPERVISOR BIT
MOVE D0,SR          * AND SET US BACK IN USER
                    * MODE

RTS
```

atari.st/tech #71, from jtuerner
a comment to 70

My documentation says that a return from supervisor mode should be made with another call to Super (BDOS \$20). After the first trap you should save D0 and push it on the stack before the second one. This is the old value of the supervisor stack pointer (SSP). The present program leaves the SSP at the same value as the User SP before the RTS. Maybe this is producing the bombs.

I have looked carefully through a BIOS listing and cannot find where the __SetScreen routine could possibly reboot. But if you try to set to a resolution not supported by your monitor, the next Vertical Blank Interrupt will branch through the routine pointed at by swv_vec (\$46E), which is initially pointing to the system reset handler.

This is in fact what happens to the "brave souls." The system reboots and they are back in monochrome.

atari.st/tech #77, from sak [Sal Magnone, CIA Software]

I read the messages about changing screen resolution without rebooting or other troubles and thought I'd mention a new program. I just got a demo of a game called Pawn that's got some really great low-resolution pictures. The significance is that the game operates in medium resolution. It pulls the low-resolution 16-color picture down from almost the top of the screen, waits, then slides the picture back up, revealing the medium-resolution text that it covered coming down. My guess is raster interrupts. Can an ST do that? When you try and dump the pictures, they get scrambled as though the interrupt got turned off. The dump routine probably does kill video interrupts, because the picture looks like someone just switched modes on it. Then it goes back to normal after the dump stops.

atari.st/tech #78, from jtuerner
a comment to 77

You can enable the HBLANK (autovector level 2) interrupt. This will give you an interrupt on every scan line. If you revector it to your own handler, you can decrement a counter set at VBL interrupt to the number of the scan line you want to change resolution, color, and so forth. If your counter reaches zero, make your changes. You may have to revector the other interrupts. This is described in the *Hitchhiker's Guide to the BIOS* (August 26, 1985, page 30).

atari.st/questions #22, from jruley

Do you still have to turn the machine off to switch between the high-resolution monitor and the modulator output? That is, can you have a black-and-white monitor and the RF modulator on at the same time? I know that would mean you'd have garbage on one or the other—but you'd be able to switch from the desktop.

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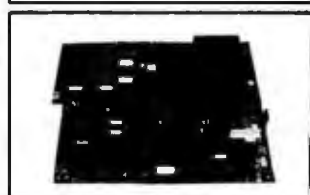
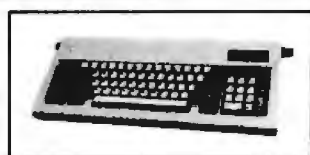
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atari.st/questions #24, from neilharris
a comment to 22

Since the video shifter puts out a 60-Hz signal for color and a 71-Hz signal for monochrome, the two modes are not at all compatible. If you fed the wrong signal into a monitor, you would be likely not only to get garbage on the screen but also to damage the flyback transformer.

atari.st/questions #26, from al [Alastair J. W. Mayer, author of BIX's CoSy software]
a comment to 24

That's no worse than feeding a 50-Hz PAL signal into an NTSC monitor (or vice versa), something I've done more than once. Garbage, yes—like a severe case of out-of-adjustment horizontal and vertical hold—but my monitor still works fine. (Mind you, I don't make a habit of it and only did it for a few minutes at a time.)

atari.st/questions #27, from jim_kent
a comment to 26

What sort of plans does Atari have for a standard video output? As it is, video-types are the only people left I can in good conscience recommend an Amiga to. (I'm a concerned animation programmer with a VCR.)

atari.st/questions #28, from neilharris
a comment to 27

The latest model of the 520ST has both RF and composite video outputs.

LANGUAGES

atari.st/main #52, from swestrup

Modula-2

Where can I get a good book on Modula-2? I'd like to decide whether I like the language before I go out and buy a copy of it.

atari.st/main #53, from jruley
a comment to 52

As to a book—it sounds corny, but I recommend *Modula-2: A Seafarer's Guide and Shipboard Manual* by Edward Joyce (Addison-Wesley, 1985). Not only is it a fairly complete reference on Modula-2 with a good index, it is actually fun to read!

atari.st/main #54, from neilharris
a comment to 53

Personally, I found the [Niklaus] Wirth book, *Programming in Modula-2*, 2nd edition, indispensable as a reference, and the Knepley and Pratt book, *Modula-2 Programming*, a good tutorial textbook. I will try to upload the sample program that comes with TDI's Modula-2/ST, which they have permitted to be passed around. It does use the GEM features.

atari.st/tech #33, from wbaker [Bill Baker]

Just started playing with Lattice C from Metacomco. My overall first impressions are that the language implementation is good, but I think the linker is a dog. A small hello-world program took five minutes to link. (I use double-sided drives.) There is a full AES and VDI library implementation with source in assembler but no real documentation other than function names and arguments.

Having tried Hippo C, Megamax C, and now Lattice, [I find] none of the C implementations anywhere near as good as TDI's Modula-2/ST. Looks like I may have to learn a new language if I want to have

development tools anywhere near as good as others I am used to (IBM PC family, Microsoft C, Brief editor, Make, and PLINK86).

atari.st/tech #34, from dmenconi [Dave Menconi]
a comment to 33

Everyone is raving about Modula-2. My problem is that I will have to learn a new language. I will probably go for it because I really like developing in Ada, and I understand that Modula-2 is like Ada. Until I get around to it, I plan to develop in Personal Pascal by OSS. This Pascal is out for the ST and is coming out for the Mac RSN. They say that something that runs on the ST can be compiled and run with no modification on the Mac (of course it will need to be tweaked to be aesthetic and efficient). If true, OSS is really going to clean up!

atari.st/tech #49, from bwebster [Bruce Webster, Consulting Editor, BYTE]
a comment to 34

No, no, no. Modula-2 is not like Ada, though both are derived from Pascal. In fact, Modula-2 and Ada represent diametrically opposed trends. Modula-2 is a very minimal language; just about everything beyond the basic language syntax is a user-defined library, though most Modula-2 implementations come with a set of standard libraries to save you the hassle of writing them yourself. Ada is a "kitchen sink" language, as in having everything but the kitchen sink. Modula-2 really resembles a hybrid of Pascal and C.

atari.st/tech #52, from wmler [William Miller, Stratus Computer]
a comment to 49

The similarity is in the concept of modules (Ada "packages") with separate definition and implementation sections. Other similarities exist due to the fact that both have Pascal as an immediate predecessor. But, as Bruce said, there is a major difference in the design philosophy.

atari.st/tech #54, from bwebster
a comment to 52

Thanks. Couldn't have said it better myself. I haven't done any actual Ada programming, though I was almost on the industry review board (read: "enormous group") back in '79 when I was leaving General Dynamics and they were offering that as an incentive to stay. (Almost worked.) I have gone through a few books on Ada, though, and have carefully read Tony Hoare's talk, "The Emperor's Old Clothes," in which he describes his horror at the thought of ICBMs guided by programs written in Ada. There is a definite dichotomy of design, despite the resemblances.

atari.st/tech #61, from jerry [Jerry Pournelle, Consulting Editor, BYTE]
a comment to 52

There are great similarities between Ada and Modula in that they are both highly structured and programs can conveniently be written in small independent packages or modules.

The difference is that Ada was designed by a committee of bright people, and Modula was designed by a single genius.

atari.st/tech #38, from jriley
a comment to 33

Looks like it's Modula or nothing. That really grates me—is there no decent C for the machine short of the \$300 Alcyon in the developer's kit?

I'd appreciate any comments—I am trying to replace Hippo C on my
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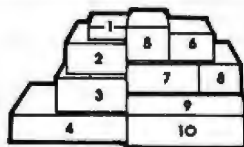
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520ST. If I don't get any kind of good news on a C by next weekend, I'm going to get Modula and chuck C for good.

atari.st/tech #46, from dmenconi
a comment to 38

I am going to do my first project on the ST in Personal Pascal. I think it is a strong alternative to Modula-2 because it has a nice library for the ST and I understand it will soon be implemented on the Mac. As far as I know, Modula-2 isn't out on the Mac yet, and when it is, there will still be the question of portability.

The questions that remain are: How optimized is the code generated by these two languages? Personal Pascal has an optimizer, and from the manual it looks like they did some intelligent things. How soon will compilers for other machines be out?

So far I have rooted for this Pascal for a couple of reasons: coming soon on the Mac, nice ST interface, most people know Pascal better than Modula-2, and Pascal's been around longer, so its compilers are better understood. But Modula-2 has some nice features, too. First, it is likely to be more portable on future machines because there is one complete language definition instead of several (the original Pascal definitions had neither strings nor good I/O). Second, Modula is, I believe, more structured than Pascal. For instance, it has packages that allow a programmer to divide a program into modules and really keep track of which packages use which routines. This is a tremendous aid in avoiding spaghetti code.

A disadvantage that awaits the unsuspecting C programmer who would use either of these languages is that they're designed to protect the programmer from himself. For example, consider the strong typing; characters are type "char"—not integer or "char" depending on how the programmer feels that day, as in some languages.

So, there you have it, a long-winded dissertation on the other two choices. I highly recommend a careful examination of both languages before a choice is made.

atari.st/tech #48, from jruley
a comment to 34

Well, I went with the Modula—maybe we should compare notes after we've both had some time to work with them. With respect to choosing between the two, I spent today reading a book on Modula-2, and it looks to me like it's possible to do anything in Modula-2 that you can do in C—although the implementations vary, they have all the same features. It's been awhile since I looked at Pascal, but unless yours has a lot of extensions (separate compilation, based variables, coroutines), there are quite a few things that will give you trouble if you try to do low-level stuff.

RAM DISK AND C FUNCTIONS

atari.st/tech #40, from mmanlove [Mike Manlove]

Here are a couple of problems that have been bugging me for a week. I'd sure appreciate any insights that you might have.

First, is there a RAM disk that works with the TOS ROMs? I've got the Hippo RAM disk, which works fine with TOS.IMG but bombs when I boot ROM. Thinking about it, it seems like most RAM disks would perform brain surgery on the BIOS/XBIOS, which is most likely in ROM.

Second, has anybody had any luck with the C library functions Malloc() and Calloc() which come with the developer's kit? The application I'm working on really wants to play around in the heap, but right now it can't. Even a trivial program can get only a little memory allocated (504 bytes for my Malloc tester), and you don't get a null pointer if there's not enough memory—you get cherry bombs. Do I need to do something magical before using these functions?

Random comments: I'm running a 1-megabyte ST with the ROMs, two double-sided floppy disk drives, and both monitors (I couldn't

decide). I've been having a fine old time with the developer's kit, but the compile/link times off floppies are getting out of control, which is why I'm after all the RAM disk I can get. The TDI Modula-2 compiler may be the next step.

Thanks again for any help you can offer. I just got here, and BIX looks great!

atari.st/tech #42, from jim_kent
a comment to 40

I use the Michetron RAM disk with the same hardware configuration (except only a color monitor). Works like a charm. I'm also curious about Malloc problems.

atari.st/tech #56, from swestrup
a comment to 40

As to the Malloc/Calloc problem: I am told that when your C program is loaded by TOS, it gives all of the memory to the program, which doesn't want it. In order to have Malloc have something to allocate, you have to do a Memfree call (I think that's what it's called) so that the memory is given back to TOS. The kicker is that the call requires the address of the last byte of memory that you want to keep. I have yet to figure out how to get this address from either the compiler or the linker.

atari.st/tech #57, from jim_kent
a comment to 56

I read in an addendum to my developer's kit (November 1985 or so) that in fact the start-up routine freed up almost all of memory and doing so was the cause of the problem. In any case I have since switched to the Lattice C compiler. Its start-up leaves your program with all but 4K bytes. Malloc calls seem to function well. I wrote a little C preprocessor (long story, it was a front end to a menu-maker package) just last week using lots of dynamically allocated memory with no problem.

Unfortunately, there was a file trashed in all versions of Lattice C that I could get my hands on—clib.bin. This is forcing me to use the “-l” option to produce .o output so I can use link68, the DRI linker. My general impression of Lattice C other than this has been a massive improvement in compile time, error reporting, and symbol size (31 characters) over Alcyon.

atari.st/tech #66, from mmanlove
a comment to 56

This is just a hip-shot (I haven't read the remaining comments yet), but the standard C “sbrk()” function seems to be implemented. Would this give the end of the program itself or the end of all the memory that TOS handed over to it? I'll do some experiments.

atari.st/tech #67, from cheath
a comment to 66

We had some problems with those memory management functions, too. I'll see if I can get my partner, the ST hack, to tell me what he figured out about them.

atari.st/tech #73, from jtuermer
a comment to 56

If you have the developer's kit, you should look at a file called APSTART.S (if it is included in your version). Or look at the source of whatever module you mention first in your link run. It starts by adding up the length of text, data, and uninitialized data segments. This information comes from the base page. The address of the base page is handed over as 4(A7) to any program. The length of the base page

(continued)

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(\$100) is also added to the total program length. A SetBlock (BDOS \$4A) then reduces the total space allocated for the program to this amount. You can change this start program or make a Malloc in your program to get more room. Someone told me that the DRI C compiler makes its Malloc allocations in the third segment (BSS). But the length of this segment is initially set to zero.

NDC COORDINATES

atari.st/tech #74, from jruley

I've just finished a frustrating couple of hours with Hippo C, trying to make my graphics terminal program resolution-independent. The Abacus GEM book lists an option on the open virtual workstation function for NDC instead of RC screen coordinates, but this does not appear to work. Is this a problem with Hippo C or with the ST?

atari.st/tech #75, from neilharris

a comment to 74

NDC coordinates are not supported on the ST version of GEM.

atari.st/tech #83, from timoren [Tim Oren, KnowledgeSet Corp.]

a comment to 74

You can't use NDC with the ST's VDI, because it doesn't have a full GDOS implemented. That also prevents you from opening workstations on other physical devices (other than the screen) and prevents doing loads of new fonts. Atari is supposed to be testing a RAM-resident GDOS which will work by stealing the VDI trap. The MiGraph EasyDraw package uses an early version of the GDOS.

GRAPHICS PROGRAMMING

atari.st/tech #79, from jruley

Help!

I am still, unfortunately, programming in good ol' Hippo C with the wonderful Abacus documentation. I need to do two things:

1. Read out the currently set color palette values. I can get the RGB representation of these values using one of GEM's inquiry functions, but how can I convert the RGB values to the color numbers (0-511)?
2. Save and restore the screen—specifically, I need a way to avoid the ugly gray blob that appears when the "fsl_input" function's dialog box disappears from the screen. I can do this by getting the screen address using "physbase" and treating the screen as an array, but the documentation led me to believe that I could use the "vro_cpyfm" function to do this.

So far as I can tell, the blasted function does not do anything. Here's how I am trying to use it:

```
static short int handle, screen[8], *sMFDB, *dMFDB;
```

usual GEM set-up

```
screen[0] = 0;
```

```
screen[1] = 0;
```

```
screen[2] = 639;
```

```
screen[3] = 399;
```

```
screen[4] = 0;
```

```
screen[5] = 0;
```

```
screen[6] = 639;
```

```
screen[7] = 399;
```

```
vro_cpyfm(handle,3,screen,sMFDB,dMFDB);
```

all sorts of stuff, including fsl_input

```
vro_cpyfm(handle,5,screen,sMFDB,dMFDB);
```

My understanding from the documentation is that the first call to vro_cpyfm should save the screen to a memory area and that the second call should restore it. This is not happening—in fact, I've tried

several variations, and so far as I can tell, the function simply does not work! Any suggestions?

atari.st/tech #80, from jim_kent

a comment to 79

Well, I can maybe help you some with the first problem. Presumably, the 0-511 value is a 16-bit word divided into four 4-bit nibbles: 0 red green blue.

Personally I don't use GEM much, but try this:

```
atari_color_reg = gem_color_reg - >r*(1<<8) +
gem_color_reg - >g*(1<<4) +
gem_color_reg - >b;
```

Or maybe the same thing with the r, g, b reversed. You also might need to scale down (probably divide by 16) the GEM component values before you fold them into the register value.

atari.st/tech #84, from jtittsler [Jim Tittsler, Atari Corp.]

a comment to 79

I don't know how you get there from Hippo C, but if you can do an extended BIOS call, you can also get the value of each palette register. The extended BIOS call 7, setColor(column, color), sets the color register column to the given color. The old color is returned (and if "color" is negative, the hardware register is not changed, so there is a nondestructive way of inquiring the value of each of the palette registers).

From Hippo C, can you do something along the lines of: for(i=0; i<16; ++i) colorreg[i]=xbios(7, i, -1)?

atari.st/tech #85, from jruley

a comment to 84

No, you can't using Hippo. But as I'm writing my own XBIOS, that'll work just fine—thanks!

atari.st/tech #86, from jruley

a comment to 85

Well, I went off and tried it—looks like it'll work!

Anybody else out there still using Hippo? If so, I'll post my XBIOS routines in Listings.

POWER PROBLEMS

atari.st/questions #2, from dbetz

I have a new Atari 520ST and have been having some problems that seem to be related to the power supply. Whenever the machine is running, the display jitters. I don't think it is related to the power in my house, since I have used many other computers without any similar problems. Also, my ST seems to be very sensitive to static electricity. I have it set up in my living room and whenever I walk across the carpet, I get a burst of "key clicks" from the ST, and if I am in an editor, I get a burst of garbage characters on the screen. I suspect that the problem is related to the power supply. Anybody have any idea what the problem is or what I can do about it?

atari.st/questions #9, from neilharris

a comment to 2

Are you running a monochrome monitor? If so, a color monitor in close proximity will cause some screen jitter due to 60-Hz vs. 71-Hz beating. Just turn off the other monitor.

atari.st/questions #10, from dbetz

a comment to 9

I was running the monochrome monitor and didn't have any other

monitors (color or otherwise) anywhere near the one I was using. I tried this in several locations in my house, so I don't think it was because I was too close to some sort of RF source. I have never had any trouble with any of the other computers I've used (including an Atari 520ST that I borrowed for a while). It really seems like this problem is related to the power supply or the main keyboard unit (I tried a different monochrome monitor also). Neil, thanks for your suggestion, but I don't think it's the source of my problem this time.

atari.st/questions #13, from mmanlove
a comment to 10

I had a similar problem with the color monitor at first. Moving the CPU power supply away from the monitor (like, down on the floor) took care of it. Don't know if this could be the problem with the mono monitor, though.

atari.st/questions #14, from dbetz
a comment to 13

Thanks for your suggestion. I didn't think of the possibility of interference from the power supplies. I had all three of them stacked right in back of the monochrome monitor! I don't have the machine anymore, so I can't check your theory, but I'll call the people that I sent it to tomorrow and suggest that they try it.

IBM PC AND COMPATIBLES

The summary of events in the IBM conference this month includes a discussion on the V series of microprocessors, coping with hard disk problems, memory expansion for the PC XT, Trojan Horse programs, and programming the IBM 5550 Japanese PC.

V20 HARD DISK PROBLEM

ibm.pc/pc.hardware #629, from lowellt [Lowell Tuttmann]

I thought that I would relate an interesting V20 experience I had in the last week. I got a "General Failure reading drive C:" on my 22-mega-byte hard disk (Micro Design) and decided it was time to reformat and reload the disk. At this time I had a V20 in place. I ran a good backup (32 floppies' worth) and then reformatted the disk. All was going well at this point. After restoring the files (many hours later) I found that I got "Parity check 2" at boot time on the hard disk. I was able to boot from a floppy and then go over to the hard disk without problems but definitely no boot. I replaced the 8088, reformatted the disk, reloaded it, and was able to boot OK with the 8088 in place. I then put the V20 back in and all is still fine. The boot process works fine, as does everything else. It is curious that I can format floppies with the V20 in place but not the hard disk.

ibm.pc/pc.hardware #631, from ucivms725 [John Leonard]
a comment to 629

I had the same problem when I reformatted my hard disk. The problem was narrowed down to the RESTORE procedure. When I backed up my hard disk, I also backed up the hidden system files of DOS (a package deal when you back up the entire hard disk). When restored over the top of the newly formatted hard disk, these hidden files overwrite the already existing DOS files from the format. My disk would not boot from the hard drive, but the files were there A-OK if the system was booted from a floppy. I found two solutions: Back up each hard disk subdirec-

tory one at a time (if you can remember them) or unhide the two system files from the first backup disk and delete them.

My V20 is working perfectly, there appears to be no problem with any operation, and I found that when used in conjunction with an 8087 I cut the processing time of a large SPSS-PC (statistical program) run from 63 minutes to 13 minutes! (I would not have believed it had I not had a copy of the printout with the start and end times right in front of me!)

ibm.pc/pc.hardware #633, from naro [Richard Naro, NEC Electronics]
a comment to 631

I would be interested in hearing the details of benchmarks with the V20. While it speeds up its internal operations, the only effect it can have on an 8087 is the time spent computing the effective address.

My guess is that much time is spent doing integer multiply/divide and string operations, which are highly optimized on the V20/V30 microprocessors.

ibm.pc/pc.hardware #634, from naro
a comment to 629

Format routines are notorious for having CPU timing loops. My guess is that the format routine is the cause of the problem, but this is the first time I've heard of it on a hard disk. The 765 floppy disk controller chip is much more susceptible to this problem.

ibm.pc/pc.hardware #635, from conniek [Conrad Kageyama]
a comment to 631

I don't know which DOS you are using, but in 3.x, there is a /P switch to the RESTORE function which will prompt you before replacing any existing files.

ibm.pc/pc.hardware #636, from lowellt
a comment to 634

I think that the problem I had was what was described in message 631. The system files were restored over the newly formatted one, and I did get a DOS error message saying "target disk may not be bootable". I was curious about its being a timing loop because my floppies were fine after formats with the V20.

By the way, I ran all the benchmarks in the "V20.arc" files from NEC and I'll be glad to post the benchmark times that I got as soon as I can find the printout.

ibm.pc/pc.hardware #638, from dgookin [Dan Gookin]
a comment to 635

Sometimes, depending on your flavor of MS-DOS, /P prompts only for hidden or system files. Very misleading and somewhat pointless.

ibm.pc/pc.hardware #639, from billn [Bill Nichols]
a comment to 638

/P is supposed to prompt for two things: attempting to overwrite a read-only file or attempting to overwrite a file of the same name but a later date. Both cases work (for me) and are valuable. /P is necessary to avoid clobbering the hidden system files. If you skip /P but restore over them, you may not be able to reboot.

ibm.pc/pc.hardware #642, from lowellt

I think I'm a little confused about the V20 and the V20-8. I gather that these are the 4-MHz and 8-MHz versions, respectively. What happens if you put a V20-8 into a regular PC?

(continued)

with up to two drives, costs an additional \$180. Contact Iomega Corp., Holly Pond Plaza, 1281 Main St., Stamford, CT 06902, (203) 359-9858. Inquiry 559.

Page Scanners for Text and Images

Vision Research announced a 300-dots-per-inch scanner that comes with image- and text-editing software and an interface board for IBM PCs and compatibles. The \$2495 Desktop Page Composition System digitizes an 8½- by 11-inch page in 7 seconds. The scanner has four contrast levels, accepts gray-scale or color originals, and can create halftones by dithering. Scanned images are stored in the MegaBuffer interface board, which provides 1.3 megabytes of RAM, enabling you to pan and zoom to any section of an image.

The MegaScan software lets you merge ASCII text with scanned images or documents. The software provides six zoom levels and enables you to edit individual pixels. It includes such capabilities as move, copy, scale, rotate, reverse, lighten, and vertical flip. An optional memory-resident program, called MegaFreeze, lets you transfer a screen image from an application program to a document you're working on and can capture up to 64 screens per document.

The system runs on an IBM PC, XT, AT, or compatible with 512K bytes of RAM and an IBM Color Graphics Adapter or equivalent. Contact Vision Research, 1590 Old Oakland Rd., Suite B-112, San Jose, CA 95131, (408) 298-8700. Inquiry 560.

Datacopy's JetReader scanner provides optical character recognition and



ITT's XTRA XL, a multiuser computer that runs DOS and Xenix.

image processing. The Jet-Reader comes with an interface board and Datacopy's OCR software and Word Image Processing System (WIPS) software. Prices for the system start at \$2950.

The scanner has an automatic paper feed and accepts a stack of up to ten sheets of paper. For images, its scan rates are about 43 seconds per page at 300 dots per inch and 28 seconds at 200 dpi. The scanner typically takes about a minute, the company says, to scan and convert a page of text into ASCII code.

The OCR software can read 12 typefaces; the optional OCR Plus package can be trained to recognize other typefaces. The WIPS software provides image scanner control, image manipulation, file management, image display, and hard-copy output. It lets you integrate images into documents prepared with standard word processors and provides editing capabilities such as scaling, rotation, cropping, and zoom. The optional WIPS Editor package (\$245) enables you to edit images at the level of individual pixels.

A second model, the Jet-Reader Plus, includes the OCR Plus software and sells for \$3250. Contact Datacopy, 1215 Terra Bella Ave., Mountain View, CA 94043, (415) 965-7900. Inquiry 561.

ITT's XTRA XL Runs DOS and XENIX

ITT introduced the XTRA XL computer, which is based on Intel's 80286 and runs both DOS and XENIX. The XTRA XL has a mass storage capacity of 144 megabytes and a reported average hard disk access time of 28 milliseconds.

The machine also features 8-MHz zero-wait-state memory, dynamic disk I/O caching, and an 8-MHz 80186-based communications coprocessor. An 80287 math coprocessor is an option. Depending on model, other standard features include 640K bytes or 1.6 megabytes of RAM, a 1.2-megabyte floppy disk, and a 40- or 72-megabyte hard disk. Multiuser configurations come with a 60-megabyte streaming tape backup unit and can handle as many as four coprocessor boards.

The XTRA XL comes in four models. Models I and II can be used as LAN servers. Models II and III can be used as multiuser systems. The LAN server configurations use ITT DOS 3.1, which eliminates the 32-megabyte disk partition requirement, the company says. The multiuser machines run ITT's XENIX System V, licensed from The Santa Cruz Operation and developed by Microsoft.

System prices begin at \$5299 for a Model I with 640K bytes of RAM, a 1.2-megabyte floppy disk, and a 40-megabyte hard disk. Contact ITT Information Systems, 2350 Cume Dr., San Jose, CA 95131, (800) 321-7661; in California, (800) 368-7300. Inquiry 562.

C for Atari ST

Mark Williams Company's C Programming System for the Atari ST features a complete implementation of Kernighan and Ritchie (plus recent extensions to the language) and UNIX-compatible libraries. Along with utilities such as make, diff, cmp, sort, wc, and egrep, the package provides an interface to GEM's AES and VDI libraries, an assembler, a loader, and an archiver.

A shell provides a UNIX-like environment and supports I/O redirection, pipes, variable substitutions, history substitutions, and path search capabilities. The full-screen editor is based on EMACS.

The C Programming System for the ST costs \$179.95. It requires two double-sided floppy disk drives (or one floppy and one hard disk). Contact Mark Williams Co., 1430 West Wrightwood Ave., Chicago, IL 60614, (312) 472-6659. Inquiry 563.

(continued)

SOFTWARE • BUSINESS AND OTHER

**Communications
Tools for Commodore
Amiga**

ATalk, a communications and terminal program for the Commodore Amiga, lets you send files using Kermit and XMODEM (Amiga loadable files are stripped of extra data sent by XMODEM programs), exchange ASCII data with systems that don't support advanced protocols, and set parameters. A script language called Dial-A-Talk, coupled with a phone-number directory, lets you log on automatically through Tymnet, Telenet, or Uninet. The software also provides full ANSI terminal emulation, with options for resizable and full-screen windows.

The program, which is not copy-protected, sells for \$49.95. Contact Felsina Software, 3175 South Hoover St., #275, Los Angeles, CA 90007, (213) 747-8498. Inquiry 589.

**Spreadsheet
Functions in an
APL Environment**

STSC's APL*Plus PC Spreadsheet Manager lets you enter and examine data in an APL environment and move data between APL workspaces and Lotus or ASCII files. APL spreadsheets can consist of character and numeric data. The package's editor is similar to that of a spreadsheet program. You can execute and store APL formulas for cells or ranges of cells, and you can sort columns or rows.

The Spreadsheet Manager incorporates direct import and export facilities for non-APL data formats. Data from Lotus spreadsheets or ASCII files can be transferred into APL variables or an APL spreadsheet file.

To use the program, you need STSC's APL*Plus PC System (release 5 or later), an IBM PC or true compatible, and at least 384K of RAM (more memory is recommended for working with large files). The Spreadsheet Manager works with Lotus 1-2-3 releases 1, 1A, and 2 and Symphony releases 1.0 and 1.1. It retails for \$195. Contact STSC Inc., 2115 East Jefferson St., Rockville, MD 20852, (800) 592-0050; in Maryland or Canada, (301) 984-5123. Inquiry 590.

Four for ST Line

Solid Applications is offering four programs for the Atari 520ST and 1040ST.

STKey is memory-resident software for programming function keys; programming can be done from within an application. STKey costs \$29.95.

DiskMenu, an archive and backup utility, provides a means of backing up a hard disk to a floppy disk. It comes with a tool for verifying disk directories and allocation tables. DiskMenu costs \$49.95.

PCalc is a calculator package that can record, to disk or printer, any calculations performed. Simple programs can be set up in conjunction with STKey. PCalc lists for \$29.95.

And PCommand, a command-line interface to TOS, supplies a command and

batch-file facility compatible with PC-DOS. It can run TOS and GEM applications. It sells for \$39.95. Contact Solid Applications Inc., 1333 Moon Dr., Yardley, PA 19067, (215) 736-2449. Inquiry 591.

**Bulletin Board for
Commodore 64/128**

Blue Board, a bulletin-board system for the Commodore 64 or 128 (in C-64 mode) from SOTA Computing Systems, supports more than 200 on-line messages (maximum 1023 characters), as many as 220 users, and 25 sysop-definable subboards. It also provides "Scribbles," little subboards that can handle messages of 80 characters or less. The company says the software is designed to give the sysop total control; the operator can reconfigure most operational characteristics, including connect time, access levels, user IDs, and mail editing. The program is written in machine language.

Blue Board requires a disk drive (Commodore 1541 or equivalent) and a 300-bps auto-answer modem (C-1650 or comparable unit). It's priced at \$69.95. Contact SOTA Computing Systems Ltd., 213-1080 Broughton St., Vancouver, British Columbia V6G 2A8, Canada (604) 688-5009. You can check out a system demo by dialing (604) 683-1914. Inquiry 592.

**Mac HFS Accessory
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PBI Software has developed a desk accessory for the Macintosh Hierarchical File System that's designed to provide quick access to files without going to the Finder. From within an application, you can use the program to locate files and the folders they're in by date or by partial/matching name. After finding a file, HFS Locator Plus can show information about it or delete, rename, move, or copy it.

HFS Locator Plus is compatible with all programs using the HFS format. The software costs \$24.95. Contact PBI Software Inc., 1111 Triton Dr., Foster City, CA 94404, (415) 379-8765. Inquiry 593.

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CommWorks, a telecommunications program for the Apple IIe and IIc, uses the AppleWorks file-folder format and features a text editor that can handle any ProDOS files (up to 35K), an automatic log-on facility, and on-line utilities that let you format disks and make sub-directories. You can define and save communications parameters and define as many as 18 sets of macros in each communications file.

The software supports ProDOS/AppleWorks and XMODEM file transfers. CommWorks functions with any Hayes (including the 2400-bps model), Apple, or Novation AppleCat modem. It runs on a IIe (with extended 80-column card and 128K) or IIc and costs \$95. Contact PBI Software Inc., 1111 Triton Dr., Foster City, CA 94404, (415) 349-8765. Inquiry 594.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

SUNDAY 10-5

ATARI PRINCE

Apple II

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CIARCIA FEEDBACK

the clock signal used for, besides operating the CPU and synchronizing peripherals?

CORTNEY E. SMITH
Tuba City, AZ

Crystal specifications for a microprocessor or microcontroller chip are maximum values. The Z80A, listed as a 4-MHz device, can be used with a crystal or other oscillator whose value is less than or equal to 4 MHz. Many system designers use a higher-value crystal frequency and divide it down to the required value. For example, a 12-MHz crystal oscillator may be divided down to 4 MHz through a couple of flip-flops connected as a divide-by-three circuit. The resultant 4-MHz signal can then be used to drive a Z80A.

Typically, oscillator frequencies are based on system performance requirements, the microprocessor or microcontroller being used in the design, and other devices on the board that require an oscillator. Keeping these considerations in mind, a designer will often use a device at its listed frequency—it is most common.

The clock signal found in all microprocessor and microcontroller applications is required to time events in the CPU, for example, instruction fetches, decodes, and operations. The clock is also responsible for generating device-select pulses (based on the microcomputer's output on the address bus) and reading and writing information from and to peripheral devices like memories, I/O ports, etc. A whole number used for the clock frequency (i.e., 4 MHz) simplifies timing calculations but is not essential.—Steve

ATARI SOFTWARE

Dear Steve,

I read your article in the June 1982 BYTE about building an interface for the VP-1000 videodisc player. I enjoyed it a great deal, except that I'm not quite good enough to write the software required for the less hardware-intensive version. Do you know of any such software written for the Atari 800? I have versions of Dragon's Lair and Space Ace that I would like to rewrite with the controller in software.

HARRY BROWN
Las Vegas, NV

An Atari version of this software is probably out there somewhere, but I am unaware of anyone who has written the code. I can give you some basic guidelines to help you write the code yourself, but I suggest that you use the interface

(continued)

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CIARCIA FEEDBACK

Listing 1: A BASIC program to control a VP-1000 videodisc player.

```
10 GOSUB 1000
20 GOSUB 1000
30 GOSUB 2000
40 X=PEEK (memory loc)
50 IF (X AND 16)=16 THEN GOSUB 2000 ELSE GOSUB 1000
60 IF (X AND 8)=8 THEN GOSUB 2000 ELSE GOSUB 1000
70 IF (X AND 4)=4 THEN GOSUB 2000 ELSE GOSUB 1000
80 IF (X AND 2)=2 THEN GOSUB 2000 ELSE GOSUB 1000
90 IF (X AND 1)=1 THEN GOSUB 2000 ELSE GOSUB 1000
100 GOSUB 1000
110 GOSUB 1000
120 END
1000 OUT port #,0:FOR CT=1 TO determined value: NEXT CT
1001 RETURN
2000 OUT port #,1:FOR CT=1 TO (determined value*2):NEXT CT
2001 RETURN
```

version in figure 5 of the article, as this will make the project easier to understand. We are causing the interface to output the pulse train in time with the serial output of the computer. That is, the output timing of the serial bits, and therefore their value to the videodisc, is totally controlled by the computer program.

The software flowchart of figure 6 (left side) shows the concept. Essentially, this will be a subroutine to pass values placed in memory by the application program to the interface. As explained in the article, you will need to send 10 bits to the machine, the first three always having the values 0, 0, and 1, and the last two always being 0. If the application program formats the five remaining bits into a stored byte in memory, you have all you need to begin.

Simply put, the routine needs only to send an OUT instruction to the desired port address (the data sent is irrelevant), wait either 1.05 milliseconds (in case data bit=1) or 2.1 ms (in case data bit=0), send the OUT instruction again, wait the appropriate time as determined by the bit value, and so on until the cycle has been completed 10 times. In BASIC, the routine might look like the program in listing 1.

The only remaining problem would be to assign the value to the FOR...NEXT loops. You could determine this using the timer found in your computer; just write a short program that prints real time, goes to a FOR...NEXT loop in which you vary the end value to vary the delay, then prints real time again. Since the value you are looking for is in the neighborhood of 0.10 second, this should help you find a value sufficiently close for this application.

I have shown what is obviously an overly simplified, inefficient approach. However, my aim was to provide enough explanation of the concept so you can easily adapt the premise to your machine. The totally software-dependent approach is not easily undertaken unless you are comfortable with assembly language programming, but the concepts shown here can be applied to that project as well.

I hope this has been some help to you. Good luck on your project.—Steve ■

Between Circuit Cellar Feedback, personal questions, and Ask BYTE, I receive hundreds of letters each month. As you might have noticed, in Ask BYTE I have listed my own paid staff. We answer many more letters than you see published, and it often takes a lot of research.

If you would like to share the knowledge you have on microcomputer hardware with other BYTE readers, joining the Circuit Cellar/Ask BYTE staff would give you the opportunity. We're looking for additional researchers to answer letters and gather Circuit Cellar project material.

If you're interested, let us hear from you. Send a short letter describing your areas of interest and qualifications to Steve Ciarcia, P.O. Box 582, Glastonbury, CT 06033.

Over the years I have presented many different projects in BYTE. I know many of you have built them and are making use of them in many ways.

I am interested in hearing from any of you telling me what you've done with these projects or how you may have been influenced by the basic ideas. Write me at Circuit Cellar Feedback, P.O. Box 582, Glastonbury, CT 06033, and fill me in on your applications. All letters and photographs become the property of Steve Ciarcia and cannot be returned.



PROGRAMMING TOOLS

BY BRUCE WEBSTER

Products with a high degree of quality are being released

It's now late March as I write this, and there isn't a whole lot new and exciting going on in the industry. Atari has finally started shipping the 1040ST, much to the relief of Atari dealers, who spent a long, dry month with nothing to sell. Prices on the Macintosh Plus have plummeted from an official list price of \$2600 to a street price of \$1900. Commodore is reputedly about to cut the list price of the Amiga to \$995 (from \$1295) and to offer another \$200 off if you buy the 512K-byte upgrade and the monitor at the same time. Summer is typically a slow time for computer sales, so by the time you read this, additional price cuts may be in effect.

Around here, things have been anything but slow. A rising tide of software—mostly unsolicited—has been flooding the door. Much of it appears to be worthwhile and well done, and it's a bit frustrating to have to pick and choose which ones to look at and which ones to set aside for now. This month, I'm going to look at some programming tools, products to help you develop programs.

A few comments before I get started. I'm impressed with the quality of the programming tools—compilers, editors, utilities, libraries, and so on—that have been released in the last year or so. The common wisdom a few years ago was that the majority of computer owners were not—and never would be—interested in programming, that just a few hackers and computer nerds actually wanted to write their own code. The phenomenal success of Borland's Turbo Pascal—selling half a million copies in a market previously estimated at 30,000 units—has spurred a renaissance of sorts, turning a small, sluggish, uncompetitive segment of the software industry into a significant market, with prices going down and quality going up. Most welcome has been the disappearance of licensing fees, so that you no longer have to pay companies an annual or per-copy amount for programs developed using their products. The winners have been both the consumers as well as the companies willing to adjust to the new market conditions. The losers, of course, are those firms unwilling or unable to change their approach or to deliver a useful product at an acceptable price.

PRODUCT OF THE MONTH: PERSONAL PASCAL

I have groused much—probably too much—about how long it took for a native code Pascal compiler to appear for the Macintosh. Imagine, then, my pleasant surprise

when Optimized Systems Software released Personal Pascal for the Atari ST machines early this year, only about six months after the ST hit dealers' shelves. Even more pleasant is that it looks to be a well-done, complete,

and reasonably priced package. Personal Pascal costs \$69.95 and comes with a 200-page manual and a single 3½-inch disk (not copy-protected).

Personal Pascal meets the ISO standard and—like all good Pascals—significantly extends it. Strings are implemented as in UCSD Pascal and Turbo Pascal, with most of the "standard" procedures and functions (except for Str and Val). Many other common procedures and functions are also present, like SizeOf, IO__Result, Seek, and MemAvail. Language extensions include long (4-byte) integers, hexadecimal constants, an OTHERWISE clause in CASE statements, and a LOOP statement, with an EXIT IF clause allowed anywhere in the loop. The last two are particularly useful in keeping a program's flow of control straightforward.

The developer(s) of Personal Pascal (the manual just credits one "J. Lohse") obviously gave much thought to modular programming. The directive EXTERNAL lets you reference and call separately compiled Pascal and assembly language routines, while the directive C lets you call routines compiled using Digital Research's (Alcyon) C compiler. Systems procedures and functions can be referenced using the GEMDOS, BIOS, and XBIOS (extended BIOS) directives. The manual doesn't make it clear how to use those directives, but it's easy once you understand it. You declare the procedure or function with its parameter list, just as you would an EXTERNAL procedure. Instead of using the directive EXTERNAL, however, you would use GEMDOS(X), where X is the corresponding GEMDOS function number. For example, to be able to call the GEMDOS routine GetDate, you might declare the following:

```
function GetDate : Long_Integer;  
GEMDOS($2A);
```

The BIOS and XBIOS directives work in an identical manner.

To use Personal Pascal, you run a program that provides a GEM user interface with three menus: desk accessories,

(continued)

Bruce Webster, a consulting editor for BYTE, is reached c/o BYTE, P.O. Box 1910, Orem, UT 84057, or on BIX as bwebster.

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ACCORDING TO WEBSTER

file (edit, compile, link, run program, quit), and options (for compiling and linking). The options items let you pre-define libraries to be linked in and set certain compiler options (range checking, stack checking, etc.) without having to use compiler directives (like `{ $R - }`) within your program.

The editor is a basic screen-oriented editor, using a WordStar-like command interface (as does Turbo Pascal) and ignoring the mouse and menus. The editor works well but has one major lack: no block marking for moving and copying text or writing text to a file. Instead, you must delete text to get it into a copy buffer, which you can then write to disk or write back into your text at some other point. The danger with this approach (as users of the old UCSD p-System editor can tell you) is that a wrong move—like a deletion when you get to where you want to insert the text—will clear your copy buffer, losing forever the text you were holding there. The block-marking approach of WordStar works a lot better: I hope OSS will consider improving the editor in future releases.

After editing your text, you can hit the F9 function key to save your file to disk and automatically start the compiler. The compiler itself is not blindingly fast, though that may be due more to the ST disk drives than the compiler itself. (A quick aside: The ST disk drives are depressingly slow. In just about every test I've run—format, file copy, disk copy, program load, and file reads and writes from within a program—the ST has been slower than the Mac or the Amiga. A good hard disk should improve things greatly.) If an error is encountered, you have the option to abort, to continue compilation, or to return to the editor. If you choose the last option, your file is loaded in, the cursor is placed where the error occurred, and an error message is printed at the top of the screen. If the compilation succeeds, the linker is run to build an executable program file. You can then run the program using the run program item in the file menu.

The biggest problem that ST programmers have had is the lack of adequate GEM documentation. About the only way to get it has been to pay \$300 for the developer's package, which includes Digital Research's C and the GEM documents (written for the IBM PC). Having done that, the programmers then have to figure out how to use the GEM routines, something said documents don't always do a great job of explaining. To remove these problems for their customers, the folks at OSS have performed a wonderful service: They have written their own GEM/Pascal library to (in their words) "make working with GEM as painless as possible." Instead of just giving access to all the GEM routines (which you can have anyway, using the C directive), they have provided a selection of regular GEM routines along with "higher-level" routines that take some of the tedium and confusion out of using GEM. Then they do a good job of documenting every routine in the library, with examples and an explanation of how each is used. Frankly, I find their explanation of how the GEM routines are used easier to understand than the GEM manuals themselves.

(continued)

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Technical support is provided in two ways. First, each copy of Personal Pascal has a unique ID number printed on both your registration card (which you should send in) and on a label that you can stick inside your manual. When you call with questions, you'll be asked for that number. It's an understandable approach to limiting technical support to legal owners of Personal Pascal. The second source of help is via OSS's bulletin board (available to registered users), which has sample programs, technical notes, and discussions about various problems and issues.

What complaints do I have about the product? Well, the manual is sparse in places, is not always well written, and needs an index. The editor could use some improvement, especially in cut-and-paste techniques. However, I prefer it over any language I've used on the ST to date, and I recommend it for anyone interested in programming on the ST, since it provides what is probably the most painless introduction to GEM I've run across.

PASCAL EXTENDER

I praised Personal Pascal for its efforts to make GEM manageable. Pascal Extender, from Invention Software Corporation, makes writing applications for the Macintosh easier. The Macintosh Toolbox routines, though more complete and better implemented than GEM, can still be overwhelming for someone programming the Mac for the first time. Or the second. Or the third. Or... well, you get the idea. One version supports MacPascal; another is for use with TML Pascal. It costs \$69.95 (seems to be a popular price) and comes with a 180-page manual and a single 3½-inch disk (not copy-protected). There are no licensing fees—though the agreement requires any software created using Pascal Extender for resale have a "Created Using Pascal Extender" statement in the manual.

The goal of Pascal Extender is to provide you with pre-declared routines and data types that make the Toolbox routines easier to use. This is done with a unit (for MacPascal) or an include file (for TML Pascal). Pascal Extender helps you in seven areas: event handling, menus, windows, controls, scroll bars, text editing, and dialog and alert boxes. For each area, you have a set of routines to help you create, use, and dispose of the appropriate items. For example, the following two routines for handling menus are among those provided in both MacPascal and TML Pascal:

- **BuildMenu(Num, Title, Items):** This function lets you add a menu to the menu bar, specifying the menu number, the title (for the bar), and the items in the menu itself (separated by semicolons).
- **StdMenus(aMenu, fMenu, eMenu):** This procedure creates and adds to the menu bar three "standard" menus: the Apple menu, with desk accessories and an "About xxx" item; the file menu, with items like "New," "Open," "Save," "Save as," and "Quit"; and the edit menu, with "Undo," "Cut," "Copy," "Paste," and so on.

A number of other routines—SetMenuItem, GetMenuItem, MarkMenuItem, DisableItem, EnableItem, Hilite-

(continued)

bits wide, then the access rates can bring it down to reasonable speeds for merely expensive RAM, perhaps 200 ns.

ATARI ST

Several applications developers and other conference members have recently been debating the pros and cons of a unified user interface for the Atari ST. While GEM's mouse-and-menu user interface established a precedent for ST applications, not all developers agree it should be used exclusively—it's a discussion that any ST owner should find interesting. Other topics covered this month are how to change the physical display base, information on a broad-band video bug, and discussions of the new OS-9 C compiler and Aicyon C.

UNIFIED USER INTERFACE

atari.st/clubhouse #141, from mmanlove [Mike Manlove]

I have a serious problem with the unified-user-interface approach: Much as we like our menus and so on, they are not always the best way to solve a given problem. I'm currently working on a sizable project that uses a fixed, always-present command list on the side of the screen. I won't go into my reasoning at the moment, but I think it's the right way to go. Now, the big question: What is the trade-off between a consistent but clunky interface and one that's different but better suited to the task at hand?

atari.st/clubhouse #142, from jriley [John Riley, University of Dayton]
a comment to 141

OK—there are *some* applications that are *not* suitable for menu/mouse operation. As a regular user of MacTerminal, I am pleased to be the first to agree on that! However, if you're going to have a GEM application that uses the menu, then you ought to stick with standard conventions.

One other convention—whether or not you are using the GEM menu bar, the Help key should give you a command list. If we can all agree on this much, then I think the rest of the problem will largely take care of itself.

atari.st/clubhouse #143, from mmanlove
a comment to 142

I couldn't agree more about the Help key. One of the first things I did with my ST was to hack a little terminal emulator, and it used the Help key because I forgot what's going on in my own programs. Then I found out that most commercial software doesn't use it.

atari.st/clubhouse #145, from cheath [Charlie Heath, MicroSmiths]
a comment to 143

I prefer to assume the user can get to the menu, which should be self-documenting as to functionality. Is that a bad assumption?

atari.st/clubhouse #147, from jriley
a comment to 145

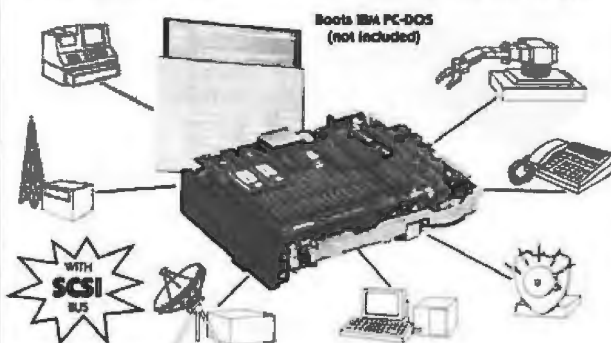
Yep. The menu bar ought to be self-documenting, but what's wrong with a little redundancy here? If I'm typing away on my word processor, it is very irritating to lift my hands from the keyboard to the mouse.

atari.st/clubhouse #148, from cheath
a comment to 147

I guess we have a difference of opinion re Help key versus menu. My
(continued)

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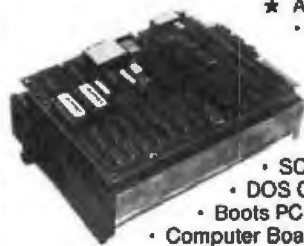
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feeling is that it is easier to wander through various menus with the mouse and just release the menu button to have the help/menu retracted. I'm not sure how easy that is to do with GEM; I know the default is to leave the menu up, but I think a clever program can get the menu to disappear when the button is released. When you use the Help key, if there are multiple pages, you need some other keystrokes to get between pages, and you need a final keystroke to get rid of the "help" and get back to work.

atari.st/clubhouse #157, from dmenconi [Dave Menconi, co-moderator of the atari.st conference]

How about this: I think most programs should have a Help menu that gives information about all the other menus and about the program in general. If the Help key were a synonym for a help item that told all about functions of the program, then different types of users would be satisfied.

atari.st/clubhouse #177, from jruley

Hmm...on the Mac I've seen a lot of applications that use the "About..." item under the "Apple" menu bar for a form of on-line help. What I suggest is that we use the Help key the same way—it ought to (at least) list the major command headings, what their general function is, and (briefly) how to use them.

For a non-GEM application (no menu bar) this is more important, but in the interest of consistency, why not do it on GEM applications as well? I mean, since we have a Help key, why not use it?

atari.st/clubhouse #144, from cheath
a comment to 141

Interfaces depend a lot on the application, but I'll assume you are writing a "mass-market" application in which there are two priorities: (1) the interface has to be simple to learn, and (2) the interface should allow "power users" to quickly access the functions they need.

I don't think a standard is necessary or good. It is nice if there are conventions; that is, if you have a choice of two equally good alternatives, you should probably pick the most likely to be used in similar applications. But to assume that all programs should use a particular interface is to limit the definition of a program.

atari.st/clubhouse #189, from mmanlove

I am on record as being a bug about the Help key. *Use it, implementers!*

atari.st/clubhouse #154, from dmenconi
a comment to 141

Right now the proposed interface guidelines are not at all consistent—no one uses them—so your method would not have to be much better.

I would caution, however, that, in my experience on the Macintosh, a developer ignores the user interface guidelines at his peril. In fact, it seems to me that there are few really good reasons not to use menus other than a simple dislike of pull-down menus.

atari.st/clubhouse #156, from dmenconi
a comment to 144

On the Mac the interface may or may not be simple to learn (I think it is, but everyone is allowed an opinion), but it's the *only* interface you will ever have to learn. All decent products on the Mac use the interface (this is a slight exaggeration, but if a product doesn't use the guidelines, many users won't use it because it is too hard to use).

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Besides, if there are guidelines, we can use them where appropriate and ignore them where not.

CHANGING THE PHYSICAL DISPLAY BASE

atari.st/questions #68, from cheath

Glitch Changing Physical Base

We're having a problem doing a double-buffered display. Occasionally, the display will glitch for what seems to be a single display frame. This happens about once every 10 minutes. We are updating the physical display base about eight times/second, and it seems that the problem must be related to this. Anybody know about a problem like this?

atari.st/questions #102, from cheath
a comment to 68

My partner figured out the problem here; it's a glitch in *The Hitchhiker's Guide to the BIOS*. To switch physical screen base, use the Setscreen call. The *Hitchhiker's Guide* states incorrectly that the actual physical base is updated during the next vertical sync; taint so. Instead, the physical base is changed immediately. That can cause an intermittent screen flash if the Setscreen call is made at any time other than during vertical sync. Therefore, just prior to the Setscreen call, you should call `xbios(37)`, which will wait for vertical sync.

Also note that the `Physbase()` call does not wait until vertical sync, as implied in the *Guide*.

atari.st/questions #103, from jim_kent [Jim Kent]
a comment to 102

Amazing. I was just down at Atari today and found this out myself. Actually, there is a system counter tied to the horizontal sync you can use too if you don't feel like waiting too much. I haven't gotten this to work yet. Interrupt vectors are scary!

BROAD-BAND BUG

atari.st/questions #79, from sprung [Ron Sprunger, R & D Tech]

On occasion, as when loading DEGAS, or a DEGAS picture, I get a half-dozen widely spaced broad black bands on the monochrome. I also have gotten them when returning from the control panel. Is this a system bug, or have I got a hardware problem?

atari.st/questions #80, from jim_kent
a comment to 79

I think I know the source of the broad-band bug. It is what you get—more or less—in the color system when you load a low-resolution picture when you are actually in medium-resolution mode. You may have the bigger, broader version of this for monochrome. It's the way the "interleaved" part of the bit map goes.

atari.st/questions #86, from jriley
a comment to 79

The vertical bars are a system problem—I also get them in DEGAS, and in Megaroids. A funny thing, though, they seem to go away after you've had the system on for a while.

Maybe it is a hardware problem, after all—does anyone know?

atari.st/questions #89, from dmenconi
a comment to 86

I have the same problem except that it seems to happen after the machine has been on for a few hours while running the monochrome (I also have color). I suspected a heat problem, so I got a can of freon, took apart my ST, and waited until it did it again. The problem goes

(continued)

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away when I hit the video chip with a blast of cold freon, so my problem is almost certainly a bad video chip. I also have a concurrent problem that the screen is shifted over about a half-inch to the right with the right edge showing up on the left. This is *not* fixed by freon, but I still suspect the video chip.

atari.st/questions #111, from alexl. [Alex Leavens, Dynamic Software Design]
a comment to 86

Do you have a homebrew 1-megabyte system (with RAM chips piggy-backed)? If not, then my fix is worthless. It only applies to those of us crazy or power-hungry enough to piggyback. I had the same problem (you should've seen my original boot screen 'til the machine warmed up) but had it fixed by Atari engineers. Seems you need to add a couple of resistors to the extra bank of RAM. If anybody needs the info, I'll see if I can dig up the exact documentation on the resistance, and where you put 'em, and all that good stuff.

atari.st/questions #116, from sprung
a comment to 111

Yes, I'm piggy. Got the machine from MicroTyme with their upgrade. I looked inside and found the chips neatly stacked and tied down the line. The locations that were mentioned elsewhere show the values they should, and Michtron's RAM disk allows a 709K disk, so memory seems to be working, but the screen is really quirky.

atari.st/questions #118, from alexl.
a comment to 116

OK, I'll see if I can dig up the info on the resistors.

atari.st/questions #129, from dsmall [David Small]
a comment to 118

Use 47-ohm resistors in series with the RAS and CAS leads coming from the MMU. They help damp the ringing and undershoot from the DRAMs. Also, be sure you use nice thick stranded wire for the top buses (like 18-gauge) and connect the wires from the MMU to the center of each bus.

OS-9 C COMPILER

atari.st/main #101, from jim_kent

Have you had experience with the OS-9 68K C compiler? Could you relate raves and/or flames if you have? I'm not all that wild about the 6809 version, though it is a gem compared to Alcyon.

atari.st/main #102, from jimomura [Jim Omura, moderator of os.9 conference]
a comment to 101

I haven't tried the 68K version myself yet, although I have the manual. My own 68K system is halted in mid-construction in part because the 68K port for it isn't done yet and in part because I'm short of cash. The current C compiler seems to have some bugs in it but not so many as to make it unusable. The OS-9 version of microEMACS, which is posted in the os.9 conference, has been compiled with it.

The latest version I know of doesn't handle bit fields within structs and unions, preprocessor #if <constant expression> (this is according to the manual—#if is partly working at least since the microEMACS has #ifdef, #ifndef, and #endif), structure assignments and functions returning type struct, and the enum and void data types.

On the other hand, it seems to support the whole OS-9 68K system itself and long relative addressing via the "remote" data type.

atari.st/main #104, from ktracton [Ken Tracton, Prima]
a comment to 101

The OS-9 68K C compiler is *great*, though it's missing some things such as nonunique struct member names. Otherwise I find it to be excellent, free from bugs, and relatively fast—remember, OS-9 uses position-independent reentrant coding. Highly recommended.

atari.st/main #105, from jim_kent
a comment to 104

Did you say nonunique struct member names? Does this mean if I have

```
struct block
{
    short xoff, yoff, width, height;
};
and
struct block_list
{
    struct block_list *next;
    short xoff, yoff, width, height;
};
```

that I get to do lots and lots of hairy editing? I hope not. Woe to me for not choosing the lowest-common-denominator compiler to develop on.

atari.st/main #111, from ktracton
a comment to 105

Normally, elements/members in a structure can be differentiated by context. Of course, as a matter of style one would use only similar names for very closely related entities. I think that this will be cleared up shortly along with the other missing bits by Microware Systems.

atari.st/main #106, from jimomura
a comment to 104

You know, both ktracton and I have noted the deficiencies of the compiler. But it's extremely powerful as it is. There is a substantial set of libraries included: ctype, dir, direct, errno, events, math, modes, module, procid, setjmp, setsys, sgstat, signal, stdio, strings, time (all of which I'm hoping to give brief descriptions of in the os.9 conference someday). The compiler options are complete *and* outside the actual compiler. We have "make" and a shell supporting wildcards, and the overall structure of OS-9 itself is, of course, like UNIX.

Many UNIX system calls are translated by the C compiler. It works for OS-9 because there are similar calls in OS-9 to substitute.

atari.st/main #107, from jimomura
a comment to 104

Ken, which version are you using? Do you have Revision D (February 1986)? It might be that nonunique struct member names are supported now.

atari.st/main #113, from ktracton
a comment to 107

I'm on Revision E version 1.3—haven't tried nonunique yet. You caught me quoting from the book—I'll try and report back Real Soon Now.

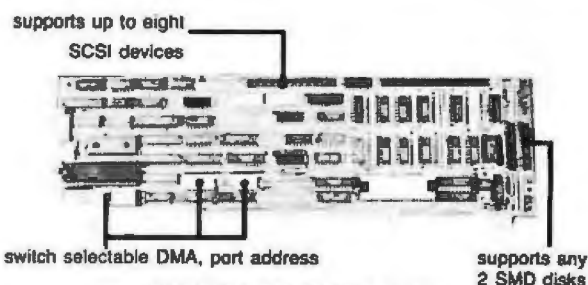
atari.st/main #116, from timoren [Tim Oren, KnowledgeSet]
a comment to 104

We have found a couple of gotchas in constant initialization: "xxxx" initializer is not supported. All number constants evaluated are as 32-bit

(continued)

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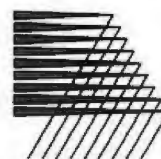
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quantities (can cause embarrassment in switch() statements).

atari.st/main #117, from jimomura
a comment to 116

As for the 32-bit initial constants, that's what I'd have expected. The compiler is based on a VAX model, and I expect type int is probably 32-bit also (I don't have my manual handy).

ALCYON C

atari.st/c.language #20, from timpanton [Timothy Pantton]

Registers in Alcyon C

Has anyone out there had any problems with registers in the Developer's C compiler? I have a function that goes

```

bug(lpt)
BYTE *lpt;
{
WORD val;
register struct g_box *gb;
    gb = g_boxes;
    while ( /* some condition that's true for about 8 iterations */ )
    {
        /* do some stuff with this g_box */
        gb++;
    }
}

```

It seems to hang the machine when lots of stuff is coming in the RS-232. The RS-232 is read by a function that is called every 20 ms by a multi-event call. All is well when the "register" is removed.

Has someone been lazy with an interrupt routine, or have I goofed?

atari.st/c.language #21, from cheath
a comment to 20

We had problems using structures, period. The structure offsets are sometimes random (or at least I could see no correlation between the output assembly code and the C source). You might do best to have a look at the assembly output.

atari.st/c.language #24, from sak [Sal Magnone, CIA Software]
a comment to 21

I agree, if the register wasn't pushed, the routine would probably blow from the first trap you got. From what I hear, Developer's C likes to be creative with struct and union offsets.

atari.st/c.language #26, from swestrup [Stirling Westrup, Xuclid Research Inc.]
a comment to 20

The bug is in Alcyon C. It doesn't properly support the register option. If you look at the machine code generated when you have the register versus the code when you don't have it, you will see that everything is done correctly except that there is either one too many pushes or pops in the register version. I forget the exact case. There is also a bug concerning arrays of structs.

atari.st/c.language #28, from cheath
a comment to 26

Does anybody know if these Alcyon problems are in all of their compilers or just in the Atari version? Has there been any attempt to get this compiler updated?

atari.st/c.language #29, from jim_kent
a comment to 28

Leonard the T. (Leonard Tramiel of Atari) assures me that Alcyon is working on it.

IBM PC AND COMPATIBLES

This month coverage of the MS-DOS conference includes some answers on how to work with the Link program and an involved discussion of memory-resident software, clock interrupts, and "de-resing" or freeing memory space.

PROBLEMS WITH LINK

ms.dos/commands #208, from geosch [George Schiro]

Is anyone out there in DOS linker land aware of any problems that can arise from using response (@) files from within a batch invocation of Link? Here's exactly what I'm getting at: l.bat contains precisely

```
link @r1 \object\%1. \execute\%1. \maps\%1. @r2
```

The batch variable %1 contains the main object filename we need linked; r1 and r2 are response files. They contain three and four filenames (with paths), respectively. Each filename is 10 to 15 characters in length. The filenames are separated by spaces. r1 contains names of object modules to precede \object\%1 in the link list, and r2 contains the names of all the libraries to be searched.

The problem is that when I invoke the linker with "l <filename>"; the linker seems to process only the contents of r1 and *nothing* else. This leads to a "library \maps\ <filename> not found" error, which is strange, since the linker doesn't even acknowledge the presence of the \maps\ ... entry (through the usual previous redisplay) prior to this error message. Can anyone out there rescue this poor soul before he succumbs to the \$300+ PLINK-86 boat nearby. One more bad link and I'm sunk!

ms.dos/commands #209, from barryn [Barry Nance]
a comment to 208

I think that if you use the Automatic Response File facility, it has to contain the entire series of responses for the linker. I don't think you can split it out between an ARF and a command-tail series of arguments.

Can you put all of the arguments (object, execute, and maps) in the ARE?

ms.dos/commands #210, from dthielen [David Thielen]
a comment to 209

I have been forced to use linker response files due to a problem with the compiler that I use. It tries to link, runs out of segments, and quits, leaving me with a response file (with the extension CLD).

I wrote a batch file that is "link /se:1024 + @%.clb". It has worked perfectly for months. My .CLB files are usually 10 to 20 lines long.

I hope this is of some help.

ms.dos/commands #211, from leroy [Leroy Casterline]
a comment to 208

Why not try this: let "l.bat" contain:

```
echo (stuff from original r1 file)
```

continued

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VOLLEYING ATARI AND AMIGA

Editor's note: The following two letters are representative of several we received on the subject, all of which were similar in opinion, if not in style.

In the May issue of *BYTE*, a letter appeared by Mike Farnsworth (page 16) giving a comparison of the Atari 520ST and the Amiga. Unfortunately, the letter contains some misinformation about the Amiga.

Concerning the Amiga, Mr. Farnsworth states, "In the low-resolution mode, those great graphics chips steal almost 75 percent... of the possible CPU time that could be used for other real-computer things." A more accurate description of the Amiga's bus timings can be found in the August 1985 *BYTE*. In brief, the Amiga's memory operates at exactly twice the speed of the CPU. Running at full speed, the CPU uses only half the memory cycle time available, leaving the other half to the custom chips. To fully utilize the 50 percent allotted to the custom chips, the Amiga could simultaneously read the disk, play four channels of audio, and show 16-color low-resolution bit-plane graphics and eight sprites with virtually no slowdown of the 68000. [Editor's note: See page 87 of the August 1985 issue for more details.] While higher screen resolution and high activity of the blitter (a custom graphics chip) will cause cycle stealing from the CPU, one must remember that these chips are doing work that would otherwise be done by the CPU, and they perform that work two to thirty times faster. As far as non-graphics timings, page 354 of the May *BYTE* contains a few benchmarks of the two machines. It should be noted that while the ST is somewhat faster in some benchmarks involving numeric computation, the expansion bus of the Amiga facilitates the addition of a math coprocessor (unlike the ST), which can speed calculations by an approximate factor of ten.

Looking at the same table on page 354, note that the difference in disk I/O ranges from a 315 percent advantage for the Amiga on disk writes, to a 25 percent advantage for the ST on random access. This brings up a point about the slowness of AmigaDOS in some activities. It is untrue, as stated, that the Amiga has anything in

common with the C-64 disk formats. Remember that the original operating system and hardware design was not done by Commodore but by Amiga. An excellent description of the AmigaDOS formats and operation can be found on page 321 of the February *BYTE*. In short, files and directory blocks are scattered on an Amiga disk. While this improves on error recovery compared to other disk formats, it is inherently slow in operations such as directory listings. Its slowness is in finding the file, but it's quick once the file is found.

Mr. Farnsworth also states that AmigaDOS is clumsy, though he gives no examples to substantiate this claim. Considering that one must reboot an ST to change from monochrome to color or from a windowing to a command-line interface, I can't see how AmigaDOS could be considered clumsy in comparison.

Finally, support for the ST has been praised. Note that about 300 to 500 pages of technical documentation on the ST can be obtained from Atari, while a full set of manuals for the Amiga contains slightly over 2000 pages. I personally doubt that Atari intends to support its customers via a support line. So from whom would you rather get support, an Amiga dealer or your local department store?

BERNIE J. LOFASO JR.
Austin, TX

The 68000 CPU used in the Amiga has about a 50 percent duty cycle. By that I mean it spends about half its time on the memory bus and the other half doing internal processing. The quoted clock figures for the Amiga are stated with respect to the CPU. In fact, the Amiga uses an internal clock with twice that speed (yielding about 14.4 MHz). The custom chips do 16-bit transfers in one of those cycles.

That means the custom chips can do one heck of a lot of transfers in the "off" cycles where the 68000 is twiddling its thumbs internally. The bus arbitration is handled, again, with the custom chips. Each of the 25 DMA channels has its own slots in the timing, which let it get its work done without interfering with the 68000.

What this means is that you can have a 320 by 400 by 4 display with four audio channels, the disk, the sprites, and the

68000 all going at the same time. The 68000 will see no contention! It doesn't even think those DMA channels are on the bus!

The blitter is a cycle-stealing device. It will use whatever cycles are not taken up by the other DMA channels and it will use the cycles normally reserved for the CPU. In normal blitter operation, it is set up to yield whenever the CPU tries to access memory on that bus. This means the CPU can get in to process interrupts, for instance, even if the blitter is in the midst of a large transfer.

The upshot is that blitter operations happen as fast as the memory can go, with 16-bit transfers continuously going at twice the memory bandwidth of the 68000, not even including any 68000 processing time that would be involved if you used it instead of the blitter. This is why the machine really screams for blitter-supported operations such as area move, area fill, and line draw.

The display coprocessor is also a cycle-stealing device. It allows raster-beam synchronized control of all the machine's custom chip functions without requiring the 68000 to take the time to perform an interrupt context switch. This is why we've got enough horsepower to slide screens around in real time while animation and graphics rendering is going on in the screens.

You can set up the display so the 68000 sees contention. The worst case is a four-plane high-res image, where the video bandwidth blocks the 68000 except during horizontal and vertical blanking intervals.

Note, however, that the 68000 can only
(continued)

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Because *BYTE* receives hundreds of letters each month, not all of them can be published. Letters will not be returned to authors. Generally, it takes four months from the time *BYTE* receives a letter until it is published.

cabling, and then reconfiguring an 8-pin DIP switch on the bottom of the drive.

The drives attach to the floppy disk ports on the Apple IIe/IIc and 128K and 512K Macintoshes or the SCSI port on the Macintosh Plus. You can use the drives to transfer text files between IIs and Macs, the company says. The drives also include a printer/spooler interface that's compatible with the Apple Imagewriter.

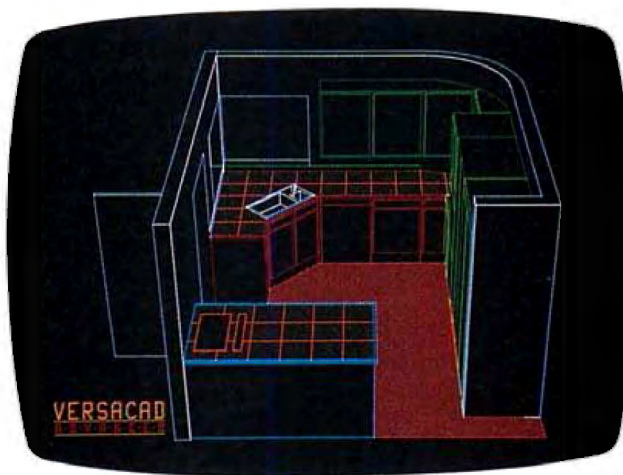
The ProAPP 1 sells for \$795; the ProAPP-20 costs \$995. For more information, contact ProAPP Inc., 1475 South Bascom Ave., Suite 101, Campbell, CA 95008, (408) 559-3552. Inquiry 559.

CAD in Three Dimensions

T&W Systems has developed a module that works with the company's VersaCAD Advanced for three-dimensional computer-aided design. VersaCAD 3D is a true three-dimensional surface modeling system that accomplishes geometric design in *x*, *y*, and *z* coordinate space, absolute or relative; isometric and perspective views include real 3D lengths rather than lengths created by 2D conversion, T&W says.

Cones, cylinders, spheres, and boxes are among the primitives in the package. They can be rotated about the *x*, *y*, and *z* axes, and most can be shown as partial objects. The program has four display modes: sketch, for a quick preview showing only front vectors; wireframe, which shows all vectors; hidden line removal, which cleans up the design; and hidden line conversion, which displays hidden lines as dotted ones.

VersaCAD 3D runs on IBM PCs and compatibles. It



VersaCAD 3D adds 3D modeling to VersaCAD Advanced.

costs \$495. Contact T&W Systems Inc., 7372 Prince Dr., Suite 106, Huntington Beach, CA 92647, (714) 847-9960. Inquiry 560.

Sony's Still-Video Recording System

Sony's ProMavica system, a still-frame video recorder, is designed for recording, storing, and manipulating video images on 2-inch still-video floppy disks. According to the company, the system can connect with IBM PC-compatible computers, allowing you to store computer-generated text and color graphics and mix them with video images on the floppy disks. The system enables you to display the images on a monitor, project them on a wall, or transfer them to hard copy. The system also lets you generate computer-controlled video presentations that can be reordered, edited, duplicated, and combined with other audio/visual media.

On each video 2-inch disk, the ProMavica unit can record 50 frames of still-video pictures or 25 frames with double the vertical resolution and with up to 360 lines of horizontal resolu-

tion. The recorder can access images, which are keyed with a 6-digit code, in 2 seconds or less.

The system is compatible with all composite video and analog/digital RGB signals from computers, cameras, videodisks, and TV tuners. The RGB input connector on the back of the unit works with IBM PC-compatible computers. The recorder has an RS-232C port as well as two 6-pin remote control ports for the company's Program Editing Controller, which enables you to make dubs between two recorders.

The ProMavica Still Video Recorder is priced at \$3400; 10 video floppy disks sell for \$100. Contact Sony Corp. of America, 9 West 57th St., New York, NY 10019, (212) 418-9470 or (201) 930-6432. Inquiry 561.

Networking Atari STs and IBM PCs

BMB Compuscience Canada released a version of its Imaginet network that connects IBM PCs and Atari STs. The network runs at speeds of up to 2 megabits per second and can transmit data over distances of up to 1500 feet

on either side of the server. Longer distances can be achieved by adding repeaters to the cable.

Up to 63 workstations can be supported by a dedicated disk and print server, which must be a PC-compatible computer with a hard disk. The server itself can be a workstation on a higher-level Imaginet network. Workstations in the network have access to several simulated disk drives and a simulated printer, which are resident on the server.

The network costs \$900 for the first IBM PC, \$800 for each additional IBM PC, and \$500 for each Atari ST. Contact BMB Compuscience Canada Ltd., 500 Steeles Ave., Milton, Ontario, Canada L9T 3P7, (416) 876-4741. Inquiry 562.

Public Domain, User-Supported Programs on CD-ROM

PC-SIG, a clearinghouse for public domain and user-supported software, is selling a CD-ROM optical disk holding 490 "volumes" (equivalent to 490 floppy disks) of applications and utilities for PC- and MS-DOS machines. The collection covers word-processing, communications, accounting, and programming software. Educational programs, games, printer utilities, languages, and BASIC development tools round out the disk.

The CD-ROM collection costs \$195; you're asked to send a donation to authors of programs that perform "satisfactorily." PC-SIG also sells a Hitachi CD-ROM player, PC controller, cabling, and software drivers for \$995. Contact PC-SIG Inc., 1030D East Duane Ave., Sunnyvale, CA 94086, (408) 730-9291. Inquiry 563.

(continued)



OFF WE GO

BY JERRY POURNELLE

I think they're trying to kill me. When this month is over, I will have spent more time on the road than I did at home. All this travel is necessary, and some of it was fun, but it can sure grind you down. Fortunately I learned a lot, so there's much to report.

COMPUTERS FOR CADETS

One place I went was the United States Air Force Academy in Colorado Springs, where I was the guest of the department of civil engineering. I hadn't thought of it, but of course the U.S. Air Force is the largest owner of pavement in the world and operates one of the world's largest construction enterprises. Besides flying airplanes, the Air Force has to design, build, and operate bases for them, which often means they must set up small, self-contained cities and provide every service from grocery stores to mortuaries.

This fall USAFA is trying an experiment: every cadet will be required to buy a Zenith 248 IBM PC AT compatible. Cadets will be given an allowance for this, and the machines will be theirs when they graduate. Meanwhile, the Academy is stringing coax cable through the dormitories: the intent is to link up all those machines into a central conferencing network. As I write this, they have chosen neither the conferencing software nor the large machines to handle the networking. I've been encouraging them to license CoSy from the University of Guelph. CoSy is the system used by BIX. USAFA and BIX have much the same requirements: electronic mail, conferencing, ability to handle 500 to 1000 simultaneous users (BIX isn't that big yet, but I expect it to be in a year or so). I have no hesitation in recommending CoSy for any reason-

Jerry hits the road in many directions and learns a great deal

able-size conferencing activity, and, after all, it was developed for academic use.

The Academy is an academic institution, but it's still owned by the U.S. government, meaning that nothing is very simple, and that particularly applies to computers. Example: if Academy professors see a piece of commercial software they think would be useful, they can't just go buy it by name, since that would be a sole-source procurement, and the government really frowns on noncompetitive purchases. You wouldn't *believe* the paperwork they have to go through just to get a compiler, or a math program, or a graphics package. Generally, one of the professors will just buy it out of his own pocket; but clearly there's a limit to how much can be acquired that way.

They do have one thing going for them. Like all the service academies, the Air Force Academy operates on an honor system, and a number of big software publishers have given site licenses to the institution: the cadets can use the software as long as they're at the Academy but can't take copies with them on graduation, and of course they don't let any copies leave the Academy grounds. It all makes sense to me. The practice doesn't cost publishers much, and it can't hurt future sales to have the U.S. Air Force officer corps familiar with a product—especially since in many cases the Zenith 248 the officer owns on graduation will be the most powerful computer at his new post. Of

course, all those computers will need software...

AUTOCAD

One outfit that has donated its software to USAFA is Autodesk, who has not only given the Academy permission to use its CAD software packages but even sent some experts out to get it all properly installed on the Academy's dozen AT&T 6300s last fall. No one at the Academy had ever used a CAD system, but they decided to use it in their design course: meaning that students and professors had to learn together.

It was a raging success. The course not only covered more ground than ever before, but the cadets were able to produce really professional-quality work—and to show not only the professors, but also the AutoCAD designers, some new uses for the program. I'm clearly no expert in either civil engineering or CAD programs, but I heard nothing but glowing praise for AutoCAD.

AutoCAD has a number of nifty features. For example, you can create a shape—say a bathtub—and store it. If you change the scale of drawing, the size of that shape will change when you call it up. To install a bathtub of that style, you retrieve it from memory, drag it about the plan with the mouse, rotate it until it's oriented the way you like, and there it is.

You can also make arrays of shapes, which gave one of the cadets an idea. He drew a parked fighter plane, moved another next to it, set that up as an array, and presto! he had a template for drawing in off-runway park-

(continued)

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future.

The West Coast Computer Faire is still my favorite computer show.

ing areas for F-15 fighters. Others added to the file so that most aircraft shapes are now in the civil engineering department's library.

This year AutoCAD could be used on only a dozen machines. Next year the cadets will be able to work on problems on their own machines. Printing their work will still be a bottleneck—the Academy has only three plotters that they can use—but even so they expect to be able to enrich their design course even more. Incidentally, if anyone out there has a couple of spare plotters they'd like to rent out for a dollar a year, you might write Colonel Swint at the Department of Civil Engineering, USAFA, Colorado Springs, CO 80840.

There's another fallout to this: the Academy is slowly accumulating computerized plans in AutoCAD format for a number of major U.S. Air Force bases, which means the cadets can have experience designing base changes, repairs after combat, and the like, working on real installations. This will cut down their postacademic training period when they leave the Academy and go out to do useful work. It probably won't hurt AutoCAD's sales, either. . .

COLLEGES AND COMPUTERS

The service academies are leading the way, but I suspect that by 1995—probably well before that—just about every college and university will require all students to own a personal computer. The advantages are just too great. Examinations can be turned in on disk rather than paper; not a big advantage in some academic disciplines, but in engineering design and other graphics-intensive course areas the savings in instructor time will be startling.

On the other hand, there may be some glitches. I'm writing this in April.

USAFA expects to have its networking system in place by August. I don't think that will be easy—yet many of the academic departments are planning courses in ways that depend not only on the cadets having computers but on their being networked. I wish them well at it, but I'd sure hate to decide on a computer, buy it, decide on software, buy that, and get it all working to link 4000 PCompatibles in four months' time.

I'm sure USAFA will survive any early setbacks. Meanwhile, the engineering professors have developed some really spiffy instructional software for PCompatibles. One demonstrates pendular motion with springs of various resiliency stressed under different conditions. Another does Hardy cross-analyses. They have drainage models, soil-stress models, and a raft of other stuff to use in engineering classes. It's all in the public domain, too. They don't have a budget for publishing or providing copies to everyone who asks, but they are very interested in suggested improvements. I'm sure that anyone who wants to make a significant software swap will get sympathetic attention.

THE ELEVENTH FAIRE

Another place I went was the West Coast Computer Faire, and I'm pleased to report that the Faire is still my favorite computer show.

It didn't have to be. Early this year the Faire was bought by The Interface Group, the outfit that brings you COMDEX and many other computer shows; and while they do those shows very well indeed, the Interface people are after all involved in a commercial enterprise; while the Faire is something very special.

I needn't have worried. Sheldon Adelson, who is president of Interface, said not once but several times that he considers the Faire "the spawning grounds of the computer industry," and "you have to give something back." He even said it again when he came down to introduce me at the talk I gave. Incidentally, he introduced me as "the consummate hacker," which is flattering but alas not really true, and as "the voice of the computer users," which comes pretty

close to what I attempt to be.

I don't suppose for a moment that start-up companies won't still have Faire troubles, but most will be due to a problem Shelly can't solve. It's expensive to put on shows in San Francisco, and made more so by the strict union contracts the city has signed. Lest someone think I'm automatically antiunion, my wife's father was a coal miner, and company cops once dynamited his house for trying to organize a union; but I do not think he would have approved of a situation in which a small entrepreneur is not allowed to move his own goods and is charged \$450 to have someone do it in five minutes with a forklift. I sometimes wonder if San Francisco really wants conventions and shows.

The Interface Group says they want suggestions from everyone who loves the Faire. Clearly they can't do everything we'd like, and they certainly don't intend to lose money; but they have promised to be cooperative. They certainly paid enough attention to me.

I do believe that Shelly Adelson will try to keep the Faire what it has always been: a place for users, developers, hackers, writers, and enthusiasts to get together. The heart of the Faire has always been the tiny little booths along the walls. Adelson deserves a lot of credit for recognizing that and keeping their costs as low as he can.

I went to this year's Faire with the nagging thought that it might be my last. It won't be.

BACCHANALIA . . .

There's one major change in the Faire. For the past several years, there have been wild parties: one year *InfoWorld* held a press reception in the Coit Tower, and another year they rented the rotunda of San Francisco's City Hall. Microsoft used to throw humongous parties.

During the salad days everyone threw parties; I can recall one Osborne affair at which Lee Felsenstein solemnly informed me that Osborne would set new standards of adequacy in party giving. I wasn't quite sure how to take that. For a few years, though, every night during the

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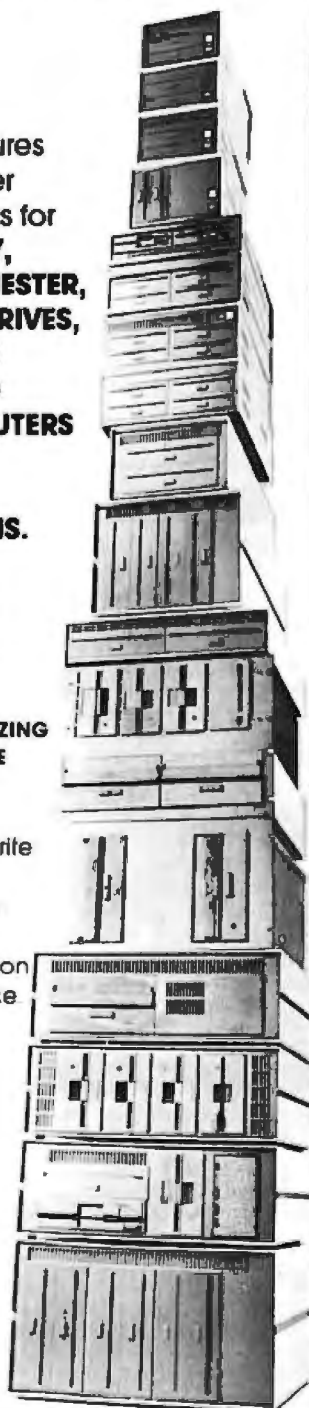
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CHAOS MANOR

Much of the excitement at this year's Faire was centered around the Atari ST machines.

Faire there was at least one big blast.

This year there were almost none. The Interface Group held a traditional reception for press and exhibitors; nothing wrong with it, but it was a pretty tame affair. Of course, *anything* would seem a tame affair after Philippe Kahn's First (and, alas, apparently Last) Annual Bacchanalia last year. Indeed, I'm told, the reason no one, including Borland, threw any kind of big party this year was that no one could think of a way to top last year's toga party. After you've seen Philippe Kahn playing a saxophone while dressed as the Emperor Nero, what's left?

ATARI AGAIN

Much of the excitement at this year's Faire was centered around the Atari ST machines. Neither Atari nor Commodore actually had a booth at the Faire, but both were well represented by users groups. In addition, Atari president Sam Tramiel showed up with his software VP brother Leonard to hold a combination users group meeting and press conference.

According to the Tramiels, Atari is in excellent shape. Sales of 8-bit machines haven't grown, but they're holding steady, and that provides plenty of cash flow for development while the new Atari ST machine sales build up. They also insist that the ST machines are selling well. I believe that, although I think some of the early sales reports were exaggerated. Incidentally, they report that in Europe about half the STs sold are monochrome; in the U.S. only 20 percent are monochrome alone; there are also "substantial" sales of both, but no numbers were mentioned.

A number of users were concerned

about math chips for the Atari ST. "We'll put in math chips when Motorola has a math chip," Leonard Tramiel said. "We won't do a kludge." They may have to reconsider that decision if they want serious penetration of the business market.

Throughout the press conference the Tramiel brothers seemed thoroughly confident. They admit that Atari had far worse financial problems than they knew before they took over the company from Warner. "It took some pretty ruthless actions," Sam Tramiel said. That's an understatement: at Spring COMDEX 1985, Atari had so few employees that even top executives were answering their own telephones. It's still a no-frills company.

As I write this, there still isn't enough software for the Atari, but there's a lot; and perhaps more important, the tools to generate software are showing up. New compilers, debuggers, documents and tip sheets, and especially new users groups make the Atari ST series the machines to watch.

HACKING YOUR ST

A lot of Atari 520 ST owners are improving the machines on their own. The original 520 didn't have the operating system in ROM; this added appreciably to boot-up time. While Atari dealers would install the ROMs for a reasonable price, I didn't have a local dealer since my 520 came directly from Atari. Friends sent me a ROM set, and following instructions given on BIX I sat down one night to do it myself.

It took about 10 minutes, and everything worked fine. A very few programs want the old operating system that boots off disk; thoughtfully, Atari has set things up so you can do that.

I also have instructions for increasing the 520's memory to a full megabyte; the same directions are available on BIX. This is a modification that Atari won't support, and since it involves soldering chips there is significant risk of doing permanent damage to your machine; but provided that you're careful it's not difficult, the parts are cheap, it adds nothing to the complexity of using the machine, and

(continued)

having a 700K-byte RAM disk sure cuts down on compile times. Anyone interested in hacking an ST should get into the Atari ST (atari.st) conference on BIX. However, fair warning, if you muck up your machine, don't blame me.

MACCARTRIDGE

Probably the most interesting thing demonstrated at the Faire was Mac-

Cartridge from David Small and Joel Rosenblum of Data Pacific (P.O. Box 10805, Marina Del Rey, CA 90295). This is a device that turns an Atari ST into a fast Macintosh.

Actually none of that's exactly true: that is, they had the MacCartridge, but they didn't exactly demonstrate it because they didn't have a booth, and even if they had they were afraid of Apple's lawyers; and an Atari ST with

MacCartridge won't run all the software you can run on a Mac.

It runs an awful lot of it, including Microsoft's Excel. (As a bonus, Excel runs 20 percent faster, too.) One secret of MacCartridge's success is that it has sockets on board for Apple's (older 64K-byte) Macintosh ROMs. Small and Rosenblum bought their ROM set from Apple; but they can't sell MacCartridge unless Apple will either sell them the ROMs at a reasonable cost or license them to reproduce them. As I write this, Apple hasn't made up its mind what to do about this.

If that weren't enough for Apple to worry about, the MacCartridge will work just fine with RAM chips in those slots, provided that you upload the Apple operating system from disk. While I was at the Faire, at least three people offered me not only disk copies of the ROMs but commented source code to the Macintosh OS, so it's pretty safe to assume that it's widespread among the hacker community. It's also safe to assume that while MacCartridge is a neat hack, Rosenblum and Small aren't the only ones who can think up a way to make the Atari run Macintosh programs right out of the box. Macintosh software developers aren't likely to be unhappy selling to this new market, either.

I don't know what's going to happen, but I think I'm in no danger predicting that by the time you read this there will be a number of ways of making an Atari pretend to be a Macintosh. The Atari may never run some Macintosh software without modification—stuff like Wizardry with really serious copy protection, for example—but much of that will eventually be ported over to the Atari anyway; and meanwhile here's yet another way to expand the Atari ST's software base.

MACNOSY

MacNosy is a serious Macintosh disassembler from Steve Jasik. I first saw it last year at the MacFaire. It has since been improved, and I've yet to meet anyone who didn't think it was worth the money.

One letter from a satisfied MacNosy

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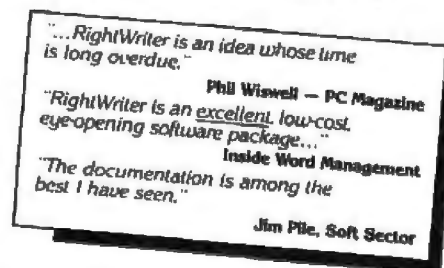
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GOING TO THE FAIRE

BY BRUCE WEBSTER

Bruce also debates product values with Commodore and Atari execs

It's late April as I write this, and a few weeks have passed since my trip to the 11th Annual West Coast Computer Faire. The Faire used to be an important trade show where new products made their debut and rival companies covertly (or overtly) scouted each other out. I attended my first Faire some years back as a representative of a software firm introducing a major revision of an existing product. I can still remember the worry about what our competitors might be bringing out and our delight in discovering that we had jumped ahead of all of them. Since all the major companies in that market segment were there, it was good news indeed.

Now the Faire has become more an exercise in nostalgia than a vital happening. As a computer industry event, it no longer matters. Press announcements, market research, and COMDEX have supplanted the Faire and reduced it to a local end-user computer show. In fact, plans are underway to hold Faires in different parts of the country.

At this point, you can insert standard sermon B-5 about How The Industry Has Matured. Sadly, all the clichés in the sermon are true: Things *have* changed irrevocably, and it ain't ever going to be as fun (or easy or cheap) as it once was to get in there and slug it out with everyone else. I don't see much evidence, though, that this maturity has improved the industry. A lot of turkeys still hit the shelves, only now many are kept alive longer than they deserve to be, thanks to fancy dressings and constant infusions of advertising money. Meanwhile, a lot of valuable, innovative products never get onto the shelves because the firms pushing them don't have the bucks to compete with the big boys.

Lest I sound too gloomy, let me hasten to add that I sense a shift of direction in the pendulum's swing. Many consumers have learned that slick packaging and gorgeous ads don't necessarily indicate a product's true worth, nor does a photocopied manual in a plastic bag mean a program is buggy or inadequate. Thanks to Turbo Pascal and similar products, buyers have learned that price and value are not necessarily related; an inexpensive product may be quite good and an expensive product quite bad. Indeed, a growing number of users are starting to suspect an inverse relationship between price and value.

A brief aside. The legend of Turbo Pascal has by now reached mythic proportions in the industry, as evidenced by the number of firms that, in marketing meetings, make

plans to become "the next Borland." As with any legend, a few ironies stand out. First, Borland didn't achieve its success by imitating another firm; instead, the company found an empty niche and gambled that it could suc-

ceed by filling that slot. Second, Borland itself is in danger of being overwhelmed by its own success and becoming (if it hasn't already) just another one of the big boys, instead of the renegade innovator that it portrays itself to be. The company seems to be falling prey to some of the common sins of the industry: not offering enough technical support, introducing too many products (some of dubious value), preannouncing new software (a practice Borland used to shun), and even advertising vaporware (will Turbo Pascal for the Amiga ever be released?). On the other hand, given Borland's track record and market position, the company can probably do what it wants to—for now, at least.

Getting back to the original topic, there is still a lot of value in shows like the West Coast Faire, the Mac Exposition, and so on, because they provide small, innovative companies direct exposure to users and to the press. Of course, they also provide exposure for small, dull companies, for large, dull companies, and other distractions, so that users and the press have to try and sort one from another. But that's part of the fun. (The question asked most often at the Faire was, "What did you see that was interesting?")

In summary, I wish the Faire a long life. I, for one, plan to keep coming back.

FAIRE HIGHLIGHTS

What did I see that was interesting? Well, the most significant product was Lightspeed C from Think Technologies, the same folks who developed MacPascal and Instant Pascal for Apple.

Lightspeed C is an integrated C development environment for the Mac that looks as though it could really speed up program development. Not only does the compiler scream along, but the linker is also amazingly quick and intelligent, allowing quick turnaround time for program changes. It appears to be a full-featured C, with complete Macintosh Toolbox and operating system support. And

(continued)

Bruce Webster, a consulting editor for BYTE, can be reached c/o BYTE, P.O. Box 1910, Orem, UT 84057, or on BIX as bwebster.

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ACCORDING TO WEBSTER

it's cheap: \$175, compared to \$250 to \$500 for most other Macintosh C compilers.

Lightspeed C was developed primarily by Michael Kahl, with help from Jon Hueras. Andrew Singer, president of Think Technologies, was involved in the product's conception and design. I just received a review copy; look for a more detailed report in the next month or two.

The most interesting product, and one which you've undoubtedly heard about, was MacCartridge from Data Pacific. This is a ROM cartridge for the Atari ST that contains—surprise!—the old 64K-byte Apple Macintosh ROMs. When used with a host program, it converts your ST into a quasi-Macintosh. There remain the small problem of disk formats (though Data Pacific offers Mac software transferred to ST disks) and the large problem of Apple legal action, which may well have killed the product by now.

David Small, who was exhibiting MacCartridge in one of the Atari users-group booths, said he was visited by a contingent from Apple, led by Guy Kawasaki (noted software evangelist) and "a lot of guys in T-shirts who talked like attorneys." Small evidently persuaded them that he had done nothing actionable and even tried to convince them that such a product would ultimately help Apple, though I suspect it would help Macintosh software developers far more than it would Apple. And since said product would also help Atari an awful lot, I see little chance of Apple giving its blessing to MacCartridge and a good chance of the company actively opposing it. Small says he has no funds to fight a legal battle and so would have to fold at the sign of any threat from Apple. It was a great hack, though...

One product that I walked by two or three times before noticing was Morgan Computing Company's Advanced Trace86, an upgrade of the firm's Trace86 debugging utility for IBM PCs and clones. Trace86 is already a good alternative to the MS-DOS Debug program, but the advanced version provides several enhancements and improvements. According to the flier, it has an assembly language interpreter that does incremental assembly of instructions as you type them in. It also allows you to create assembly language programs and save them as .COM files. The program runs on IBM PCs with at least 128K bytes of RAM. Since 8086 assembly language programming is not one of my strong points, I'm very interested in using this to help me make the plunge. Look for a follow-up here once I get a review copy.

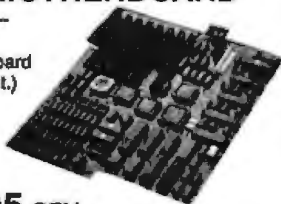
There weren't too many finished (shippable) Amiga programs showing at the Faire, but I did see a beta-test version of Mimetics Corporation's Sound Scape, a program that turns your Amiga into a synthesizer and MIDI (musical instrument digital interface) sequencer. Adding a MIDI adapter to the serial port allows you to receive MIDI commands from other devices, or you can use the Amiga's keyboard as, er, a keyboard. Watching the demo, I got the feeling that I could really compose some interesting (and maybe even enjoyable) music with it, prompting BYTE's Ezra Shapiro to comment on the "triumph of technology over talent." A finished version of Sound Scape should

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show up here in a month or two; again, look for a more detailed report then.

One Amiga product that is being shipped is a version of Aztec C from Manx Software. You may recall from my May column that I ended up switching from Lattice C to a beta-test copy of Aztec C for most of my Amiga benchmarks, with a significant improvement in times. Not only that, but Aztec C has its own linker that works a lot faster than the standard Alink program that Lattice C uses. I'll be curious to see if this "finished" (is any compiler ever finished?) version is any better. Jim Goodnow, who worked heavily on the Amiga version, gave me some additional good news: Manx is porting Aztec C to the ST.

MEANWHILE, DOWN AT THE RANCH

My trip to San Francisco included visits to Atari and Commodore. At Atari, Neil Harris and Leonard Tramiel spent a fair amount of time with me, doing their best to answer some of my criticisms of the ST and to explain strong points I might have overlooked. In some respects, they were preaching to the converted—I think the 1040ST is a great machine and that Atari will probably sell as many as they can produce—but I appreciated their comments nevertheless.

Tramiel argued that GEM Desktop, the user interface on the ST, is just as powerful and easy to use as the Macintosh Finder. He made the valid point that "different" doesn't necessarily mean "better" or "worse" and that many users are so accustomed to the Macintosh Finder that they perceive GEM Desktop's differences as deficiencies. He also pointed out some of GEM Desktop's advantages, such as the ability to open a disk's window multiple times so that you can view different portions of a directory simultaneously.

Still, I think GEM Desktop is rigid and demanding compared to Finder. All windows have to be organized the same (names versus icons, as well as method of sorting). You can't rearrange icons within a window. Viewing by icons forces you either to open the window the full width of the screen or to do a lot of horizontal scrolling, since the icons are not adjusted to fit within the current window size. And those infernal drop-down menus are always getting in the way, requiring a lot of extra button pushing compared to Apple's patented pull-down menus. The irony is that GEM's developers at Digital Research designed the drop-down menu to avoid patent infringement and wound up having legal problems with Apple anyway.

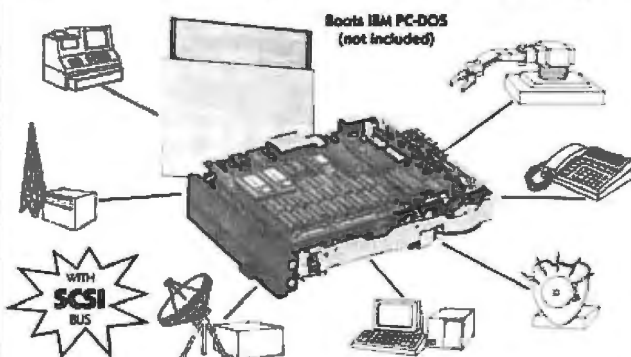
Tramiel is right about one thing: I have been spoiled by the Macintosh, and I tend to resent GEM making decisions for me that I would rather make myself.

Tramiel and I agreed on another point, namely, the ease of low-level access within the ST. He showed me an animated three-dimensional Bessel wave function running through a 20-step cycle at an amazing rate of several cycles per second. The method was simple: All 20 steps were individual screen images that had been predrawn (at about 3 minutes each) and saved on disk. The demo program then loaded the 20 pictures into RAM, eating up 640K

(continued)

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bytes (this was on a 1040ST). The program created an animation effect simply by changing the screen pointer successively to each of the 20 images. This simple technique would be impossible on the Macintosh and would be limited by the 512K bytes of "chip RAM" on the Amiga 1000.

The ST makes it easy to get down and mess with the "guts" of the machine; with the Macintosh and the Amiga, both the hardware and the system software tend to get in the way. I think that's very much the reason why ST software has come onto the market so quickly, while Amiga software has lagged behind.

The mood at Atari was upbeat and aggressive. The 1040ST and the new 520ST started shipping in March, relieving a lot of dealers who went through a lean period with few machines to sell. Atari even released an explanation for the delay in shipping: A plane loaded with 1040s was on its way to the U.S., stopped in the Philippines for refueling, then was unable to take off again for a few weeks due to the political upheavals caused by the then-pending presidential election. There *are* signs that the initial 1040STs were shipped in a hurry. For example, the initial models that dealers received did not have the promised RF modulator, though there was space for the circuitry on the motherboard and even a cutout on the internal shielding for the RF wiring to pass through. The customers don't really seem to care, though; reports are that the 1040ST is selling just fine.

GOOD SIGNS FROM COMMODORE

At Commodore, as well as at the local ComputerLand-Amiga show in San Jose, indications are that the company is finally getting its act together with regard to the Amiga machine.

First, Commodore planned a large exhibit at COMDEX/Spring. Commodore's absence at COMDEX/Fall and the Winter CES hurt them with developers and dealers.

Second, Commodore has a "limited time" offer of an Amiga 1000 plus an RGB monitor for just \$1295; in effect, the monitor is free. That significantly shrinks the price gap between the Amiga 1000 and the ST models, a gap that had grown with the introduction of the 1040 and the unbundling of the 520.

Management changes are also encouraging. These include shifts in location (back to the West Coast) and changes in the people who handle third-party developers. Ever since Commodore moved third-party relations last year to West Chester, Pennsylvania, developers have been complaining about lack of cooperation from the company. Prior to that move, Caryn Mical (née Havis) had been doing an outstanding job in the West Coast office.

Finally, Commodore's new magazine ad campaign (touting the special bundled deal) appears to be better conceived and executed than previous efforts. It relies on understatement and simplicity rather than hoopla or bizarre imagery and makes the Amiga look like a business machine—something Commodore very much wants.

Even with all that, I still get a sense of carefully guarded frustration from some of the current employees at Com-



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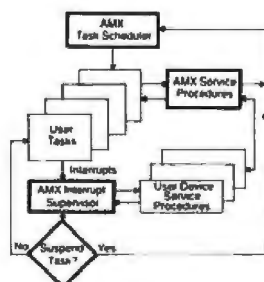
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the memory doesn't get returned if it used the same 200 to 600 bytes each time. But it seems to lose an additional 200 to 600 bytes each time my program gets behind. My loop is similar to one on pages 8 to 14 of the Intuition manual; I just have a lot to do. Will this memory be returned in a later version, or will I have to periodically close, then reopen my windows to reclaim this memory and keep my program from suffering memory crashes?

amiga/softw.devlpmt #1601, from cheath
a comment to message 1599

Are you replying to all messages that you receive? You shouldn't lose memory if all the messages have been replied to. Perhaps Intuition has to allocate more space for messages and doesn't free up its local pool. You might consider flushing the input when you get behind. Whenever you get a MOUSEMOVE event, set a flag and continue to read messages until you get something other than MOUSEMOVE (including "no more messages"). (Also, make sure to reply to each message after reading.) Then, test for the "mouse moved" flag before processing each event.

amiga/softw.devlpmt #1602, from skrenek
a comment to message 1601

Right. According to the documentation, Intuition does allocate more memory for the messages and doesn't return that memory. RKM (volume 1, pages 3 to 108) seems to imply (and it seems to be true) that the newly allocated memory is not reused if you get caught up, then behind again. Instead, it seems even more is allocated. So each time you get behind, that amount of memory is permanently lost. Well, not permanently. It's returned if you close the window, but that doesn't help if you run out of memory and crash.

As I said, my program is similar to the one in the Intuition manual. The only difference is that instead of setting a flag inside the loop, my program completely ignores MOUSEMOVE messages inside the loop, but responds if the last message as it leaves the loop was a MOUSEMOVE.

```
Wait( ... );
while(message = GetMsg( ... );
{
    copy the info
    class = message -> Class;
    Reply(message);
    if(class != MOUSEMOVE) ProcessMessage( ... );
}
if(class == MOUSEMOVE) ProcessMove( ... );
goto Wait;
```

amiga/softw.devlpmt #1610, from jbitt [John Bittner]
a comment to message 1599

If your application permits, you could do an Smodify(DCMP) and turn off REPORTMOUSE whilst you do your processing, then do it again when you're ready for more Mouse Info.

amiga/softw.devlpmt #1614, from cheath
a comment to message 1602

Hmm. You shouldn't have any problem with that, I don't think. Are you getting behind because of menu activity? You'll keep getting MOUSEMOVE events while the menu is active, unless you set window->flags &= REPORTMOUSE; while the menu is on-screen.

ATARI ST

The Atari ST conference remains a great source for technical information on this machine. This month's peek at the conference begins with hopeful questions on Atari ST/IBM Convertible disk compatibility. The next section is a rather long look (with code samples included) at screen handling problems related to menu selector boxes. The peek ends with a quick discovery of (and factory response to) an undocumented control vector and a surprisingly civil discussion of programming editors for the ST.

IBM CONVERTIBLE/ATARI ST DISK COMPATIBILITY
atari.st/main #143, from rhonesty [Robert Honesty]

The company I work for got in one of the new IBM PCs with a 3½-inch disk drive. So, I took a 720K disk from the ST in to try it out. No luck. IBM (predictably) wouldn't read it. I tried alternate plan two. Formatted on the IBM and tried reading on the ST. Success! Now I can skip the plan to get a 5¼-inch drive. I tried out VIP WKS files with 1-2-3. Nirvana! If I get the time I'll try and figure out why IBM has such problems.

atari.st/main #144, from al [Alastair J.W. Mayer, author of BIX's CoSy software]
a comment to message 143

Problems are probably due to some subtlety in the way formatting is done. Anyway, a couple of questions: Assuming the disks are formatted on IBM (so both IBM and ST can read them), can you write a file with the ST that the IBM can read? (I think your message implies this, but not sure.) What other machines using 3½-inch disks is the ST read-and/or write-compatible with? Anybody got firsthand experience?

atari.st/main #145, from timoren [Tim Oren, Knowledgeset Corp.]
a comment to message 143

The reason for this is that the PC and the ST use different disk controller chips—with the ST using an "older" type. The upshot is exactly the effect you describe: PC-formatted disks read on the ST, but not vice versa. Not being a hardware person, I can't describe the reason in detail.

atari.st/main #146, from [tuermer [Joerg Tuermer]
a comment to message 143

Did you try a disk formatted on the ST, but with the boot sector being an exact copy of the IBM boot sector (this can be made with a disk monitor)? Maybe the IBM is more finicky than the ST as to what it expects to find (like an IBM logo).

atari.st/main #147, from rhonesty
a comment to message 144

Yes, the IBM can read ST files.

atari.st/main #165, from ptoland [Paul Toland]

I've just logged on for the first time in a couple of weeks and have seen the stuff on reading IBM 3½-inch disks. I've tried reading disks from my Data General One on the ST and they read OK as well. Going the other way is a bust, and the info from the DG/One looks as though it's having trouble picking up the first directory block.

(continued)

atari.st/main #171, from dsmall [David Small]
a comment to message 165

I believe you will find that disks formatted on the ST are unreadable with NEC and NEC-like (Intel 8272) floppy controllers, as in IBM anything. However, you can read and write IBM-formatted disks with the ST. This applies to 5¼-inch disks, but I can't think of a reason it would not apply to 3½-inch disks as well.

SELECTOR BOX PROBLEMS

gem/atari #25, from jruley [John Ruley]

TITLE: fsel_input

```
/* this is a code fragment to display a file selector
box */
/* works in Hippo.C—should work in Alcyon or others */
char d_path[256], f_spec[256];
short int ret;
strcpy(d_path, " \\ *.");
strcpy(f_spec, "_____");
graf_mouse(0,0);
graf_mouse(257,0);
ret = fsel_input(d_path, f_spec, &button);
graf_mouse(256,0);
...
/* ignore all the graf_mouse commands—that's 'cause
I've got the mouse turned off when I start.*/
```

Problem—when the selector box goes away, it leaves a big gray blotch in the middle of the screen. So I need something that will save the screen before, and restore it after, the fsel_input call.

gem/atari #32, from alexl. [Alex Leavens]
a comment to message 25

You could do a form_dial on the area to save it. Code fragment is

```
int return;
int (all your system variables)
.
.
return = form_dial(0,0,0,0,Box_x, Box_y, Size_x,
Size_y);
if(return == 0)
    printf("Error in allocation memory for box ");
.
.
Now do your fsel_input stuff . . .
.
return =
form_dial(3,0,0,0,Box_x,Box_y,Size_x,Size_y);
.
.
Ta-da! You're done. Box_x and Box_y are the x and y coordinates
of the upper left corner of the box. Size_x and Size_y are the size of
the space you want to save (should be greater than or equal to the
menu that you want to draw).

```

If you want to get fancy, you can use functions 1 and 2 of the

form_dial command to draw a growing and shrinking box, respectively.

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gem/atari #35, from alexl.

A form_dial(0, . . .) saves whatever's under the area that you've defined, and a form_dial(3, . . .) restores it (by telling the system to do a re-draw). I admit it ain't real clear in the Abacus books. It ain't real clear in the DRI documentation either . . .

gem/atari #36, from jruley
a comment to message 35

Sorry Alex—I just tried it, and it does not work.

I'm not sure what the form_dial(0 . . .) did, but the form_dial(3 . . .) attempted to restore a GEM desktop—I got the clear top line, and gray in the rest of the screen. Maybe this is happening because I'm not using a window?

This is all sort of beating around the bush anyway—does anybody out there savvy the raster ops for blitting? I think that's more what I need. . . .

gem/atari #37, from alexl.
a comment to message 36

Absolutely. I savvy the blitter ops (having used them plenty myself). What do you want to know? By the way, you say you're not opening a window . . . what exactly do you mean? Are you not using the "open virtual workstation" command (v_opnvwk)? Or something else? Please explain further; maybe I can figure out the problem.

gem/atari #38, from jruley
a comment to message 37

Ummm . . . might be better if I set up a short demo program and put it in listings. I am using the open virtual workstation but am sending text and graphics directly to the screen, without opening a window with the w_whatever() commands.

Let me put up some code in listings and we can talk then.

gem/atari #39, from jruley
a comment to message 38

Okay, I've generated a demo which shows the problem—it's in listings as "idiot.c"—compiles under Hippo (with my own XBIOS—if you need it, I will post that too), should compile under Alcyon. It's a GEM application. Operation should be obvious if you read the comments. Run it with all three screen-save routines—none, mine (non-GEM, using physbase()) and a 32K character array), and Alex's (using form_dial, as we've discussed). If you can fix it so that form_dial works, or suggest an alternate routine (blitting?), I'll be VERY grateful!

gem/listings.st #7, from jruley

TITLE: idiot.c

```
/* idiot.c
an example to show my problems with
screen save & restore—J. Ruley */
/* static globals: */
/* set up for GEM operation */
static short int xnyr;
static unsigned char *gbuf, scrn[32000], *physbase();
/* set up for GEM operation */
/* set up for GEM operation */
main(){
    short int work_in[12], work_out[57], handle;
    char d_path[256], f_spec[256];
    short int ret, x, y, i;
    handle = graf_handle(&x, &x, &x, &x);
    for(i=0; i<10; i++) work_in[i] = 1;
    work_in[10] = 2;
    v_opnvwk(work_in, &handle, work_out);
    /* now set up a test screen */
    v_cirwk(handle);
    ret = vst_effects(handle, 12);
    vst_height(handle, 16, &x, &x, &x, &x);
```

```

ret = vs_point(handle,16,&x,&x,&x,&x);
xr = work_out[0];
yr = work_out[1];
x = xr / 4;
y = yr / 2;
v_gtext(handle,x,y,"Testing . . .");

/* post an alert box to select the type of screen save
*/

ret = form__alert(2,1,"Screen save
type:[none|mine|alex's]");

/* save the screen */

sav__scrn(ret);

/* get a filename */

strcpy(d__path," \ \ .");
strcpy(f__spec,"");
i = fsel__input(d__path,f__spec,&x);

/* restore the screen in the selected way */

rst__scrn(ret);

/* wait for a keypress */

conin();

/* and quit */

v__clswrk(handle);
appl__exit();
}

/* subroutines: */

sav__scrn(n)
short int n;
{
short int ret, i;
if(n == 2){
    gbuf = physbase();
    for(i=0;i<32000;i++)scrn[i] = *gbuf++;
}
if(n == 3){
    ret = form__dial(0,0,0,0,0,0,x,y,r);
}
}

rst__scrn(n)
short int n;
{
short int ret, i;
if(n == 2){
    gbuf = physbase();
    for(i=0;i<32000;i++)*gbuf++ = scrn[i];
}
if(n == 3){
    ret = form__dial(3,0,0,0,0,0,x,y,r);
}
}

```

gem/atari #41, from alexl.

TITLE: Saving/Restoring Screen

I spoke with Leonard Tramiel yesterday, and he suggested the following:

1) If you're using the fsel__input call, pay attention to the GEM message buffer (which will tell you that you need to do a redraw), and then do it.

2) If you don't want to do that, use (as you figured) the bit calls, to blit the screen memory to a safe location, and then blit it back again. See my listing of Crabs.C in the listings section for some code on how to use the bit. If you need more help, drop me a line. I'm going to see if I can't get Atari to let me post the source code to the demo accessory and application that come with the developer's kit.

gem/atari #42, from timoren
a comment to message 32

To be strictly technical, form__dial doesn't actually save the desktop area. Instead it tells the system to redraw it. Subtle distinction but important.

gem/listings.st #8, from alexl.

TITLE: File Selector Listing

This is a listing of a simple program which will open a (non-functional) window, and then a file selector box, which will let you do all sorts of file selector types of thingies.

SELECT.C

Test program to show how to pull up a file selector dialog, and save the underlying window. Note that although the form__dial successfully redraws the window, that part of the internal structure of the window gets roached by the file selector. This is because the window itself is not being redrawn (which is up to the programmer, and which I've left out, being the lazy sot that I am).

```

#include <osbind.h>
#include <define.h>

#define HIDE__MOUSE graf__mouse(256,&dummy)
#define SHOW__MOUSE graf__mouse(257,&dummy)

int contrl[12], intin[256], ptsin[256], intout[256],
ptsout[256];
int handle;

int res1[4] =
{
0, 15, 320, 170
};

int res2[4] =
{
130, 15, 380, 170
};

int res3[4] =
{
130, 35, 380, 330
};

main()
{
int i, dummy, mx, my, num__colors;
int charw, charh, boxw, boxh;
int wind__handle;
long boxadd;
int mgbuff[8], pxy[4];
char decimal[4];
char d__path[256], f__spec[256];
int x,y,w,h,xdial,ydial,wdial,hdial;

/* Set the system up to do GEM calls*/

appl__init();

```

(continued)


```

/* Get the handle of the desktop */
handle = graf_handle(&charw,&charh,&boxw,&boxh);
/* Open the workstation */
for (i = 1; i < 10; ++i) intin[i] = 1;
intin[10] = 2;
v_opnvwk(intin, &handle, intout);
pxy[0] = 0; pxy[1] = 0; pxy[2] = intout[0]; pxy[3] = intout[1];
/* Find out what res mode we're in */
num_colors = intout[13];
vs_clip(handle,1,pxy); /*turn on clipping*/

```

Now open a very simple window, strictly designed to show if we are, in fact, restoring the desktop after the call to fsel_input...

```

/* Open a window. Note that even though all
elements of the window are present (slider, kill box,
etc.) None of them work! */
wind_handle = wind_create(0x0FFF,50,50,200,150);
i = wind_open(wind_handle,50,50,200,150);

```

```

x = y = w = h = 0; /* size of smallest box, i.e., non-
existent */

```

Now, get the size of the file selector input box, depending upon the resolution mode that we're in. Note that these are hand-calculated values. I looked *real close* at the screen and tried to figure out how many pixels the sucker was.

```

/*
if(num_colors < 3) /* Monochrome
resolution */
{
xdial = res3[0];
ydial = res3[1];
wdial = res3[2];
hdial = res3[3];
}
else
if(num_colors < 5) /* Medium res,
color (4 colors) */
{
xdial = res2[0];
ydial = res2[1];
wdial = res2[2];
hdial = res2[3];
}
else /* Low res, color (16
colors) */
{
xdial = res1[0];
ydial = res1[1];
wdial = res1[2];
hdial = res1[3];
}
}

```

```

/* reserve room on the screen */

```

```

form_dial ( 0, x, y, w, h, xdial, ydial, wdial,
hdial );

```

```

/* draw a growing box */
form_dial ( 1, x, y, w, h, xdial, ydial, wdial,
hdial );

```

```

/* get a file name */
strcpy(d_path, "\ \ .");
strcpy(f_spec, "_____");

```

```

i = fsel_input(d_path,f_spec,&x);
/* draw shrinking box */
form_dial ( 2, x, y, w, h, xdial, ydial, wdial,
hdial );
/* free up screen area */
form_dial ( 3, x, y, w, h, xdial, ydial, wdial,
hdial );
/* Wait for a mouse click to end the program ... */
evnt_button(1,1,&mx,&my,&dummy,&dummy);
/* Close the window */
wind_close(wind_handle);
/* Close the workstation */
v_clsvwk(handle);
/* Release GEM calls */
appl_exit();
}
/*-----Plot(x,y)-----*/
Plot(x,y)
{
int pxy[4];
pxy[0] = x; pxy[1] = y; pxy[2] = x; pxy[3] = y;
v_pline(handle,2, pxy);
}
/*-----End of Plot (x,y)-----*/
/*-----rand()-----*/
/*This function will return an 8-bit random number*/
rand()
{
return(Random() &0x00FF);
}
/* End of
rand */

```

SYSTEM VECTOR EXPLORATIONS

atari.st/tech #172, from hisoft [Dave Howorth]

For trivia freaks, there is a (to my knowledge, undocumented) system vector at \$502 which points to the screen dump routine, called by the BIOS trap and Alt-Help. If you change it, you can do screen dumps on any printer of your choice. The Amiga conference has people from Amiga on it who read messages like the one above and then say, "We'll define it so you can use it," or "Don't use it—it's gonna change." Is there anyone from Atari on this conference with similar knowledge?

atari.st/tech #178, from jtittsler [Jim Tittsler, Atari Corp.]
a comment to message 172

The vector at \$502 (scr_dump) is a safe vector for the ROM TOS only. We will maintain it in future versions of the operating system. There are also individual vectors for printer device output:

prtblk character-output vectors

Prtblk() uses four vectors to output characters to printer devices. The vectors are in protected OS memory. "prv_1st" initially points to the PRN: device output status, and "prv_1st" initially points to the PRN: output driver; "prv_aux0" initially points to the AUX: (RS-232) device output status, and "prv_aux" initially points to the AUX: output driver. Prtblk() uses the PRN: or AUX: vectors based on bit 4 of the printer

configuration word (see the guide). Output of `Prtblk()` may be redirected by modifying the appropriate vectors.

Prtblk() Output Vectors				
<code>prv_justo:</code>	1	<code>ds.l</code>	:	<code>(506) -> _jstostat()</code>
<code>prv_just:</code>	1	<code>ds.l</code>	:	<code>(50a) -> _jstout()</code>
<code>prv_auxo:</code>	1	<code>ds.l</code>	:	<code>(50e) -> _auxostat()</code>
<code>prv_aux:</code>	1	<code>ds.l</code>	:	<code>(512) -> _auxout()</code>

In general, the policy is, if the vector is listed in the "System Variables" section of the guide, their locations and meanings in future revisions of the ST BIOS will not change.

A QUESTION OF EDITORS

atari.st/tech #191, from *davjon* [David Jones]

TITLE: Program Editors

One thing that occupies my mind over here in the U.K. is, What is the best ST program text editor? I find that most of the editors that I have used on the ST (1st Word, GSTEDIT, Modula-2 Editor, MicroEMACS, Metacomco ED, Hippo-C, et al.) always have some annoying feature, like not auto-indenting, for example. I would be really interested to know what other developers think about the available editors.

atari.st/tech #192, from *sprung* [Ron Sprunger]
a comment to message 191

I've given up on 1st Word and TDI M2 editors, and use only MicroEMACS, which is adequate, though lacking somewhat. All I want is the Turbo Pascal editor, which I can run completely from the home position on the keyboard, and which I can make behave like the Alpha Micro editor VUE. EMACS is not bad, but it's always in insert mode, uses commands in drastic disagreement with those of VUE or WordStar, pages backward awkwardly, has no built-in search and replace (macros are neat, but I don't want to use them for every search and replace, and especially not for globals). It also inserts real tabs, which I have to filter out before sending text to the M2 compiler. Still, it is far and away the best available for programming and does not require me to fiddle with a silly mouse, or grope for function keys.

atari.st/tech #194, from *sgrimm* [Steve Grimm]
a comment to message 192

I always use Regent Word to program, for the simple reason that it is very, very fast. I hate having to wait for EMACS to update the screen when scrolling through a file. Also (and I know this isn't of world-shattering importance), you can select a file to load with one keystroke. The only complaint I have about Regent Word is that it can't load files from subdirectories.

atari.st/tech #195, from *mmallett* [Mark Mallett]
a comment to message 192

User *sprung* says: "EMACS is not bad, but it's always in insert mode." Editors being like religions, this is probably one of the major fissures in the faiths of the followers of editors: moded vs. non-moded editors. Many would claim that one of the great points of EMACS is that it is always in the same "mode" (I am one who would claim this.) Having to remember, when using an editor, whether one is in insert or command mode is something that can drive a person like me insane (maybe that is what did it). *Sprung* also comments, "It also inserts real tabs," which have to be filtered out before being given to a compiler. I would claim that the problem is in the compiler. I would class as unusable an editor that refuses to store tabs as tabs (e.g., the MIX editor).

atari.st/tech #199, from *conover* [Harry Conover]
a comment to message 192

MicroEMACS isn't bad, but it can't be compared to a real programming editor like vi, which I understand will be soon available for the ST. I still haven't learned how to go directly to line *n* to correct a diagnostic-detected error. Can you tell me how?

atari.st/tech #202, from *alexl*.
a comment to message 199

Get to the beginning of a file. Type `<ctrl> u`, then enter the line number for the argument. Then press the down arrow key. Ta-da!

atari.st/tech #203, from *sprung*
a comment to message 195

You misunderstand me on modes. I mean "insert" as opposed to "overwrite."

I don't care if an editor splits the work between edit and command modes, and I use editors of both persuasions. As for tabs, certainly the M2 compiler is remiss in not ignoring them, but it is not alone in that respect. I personally prefer the tabs and don't mind running everything through *detab* before compiling.

IBM PC AND COMPATIBLES

The IBM PC conference excerpts concentrate on software this month, with three discussions centering on various aspects of DOS. First, there is a question (and, yes, answers) about format problems with specific hard disk/controller/DOS combinations. Next, BIXen get into a thorough look at *exactly* where in memory DOS begins and ends. Finally, someone asks how to create a file of precise printer output for debugging purposes. Several software solutions are proposed.

DOS 3.1 FORMAT PROBLEMS

ibm.pc/pc.hardware #779, from *smack* [Steve Mack]

I have a WD (Western Digital) controller and a Rodime 30Mb HD that were formatted with DOS 2.1 until a couple of days ago. I got tired of 8K clusters and wanted to do a low-level format anyway, due to a new bad sector, so I BACKUP'd, formatted, and tried to bring up DOS 3.1. The FDISK went OK, made entire disk my DOS partition, but then "FORMAT C:/s/v" would say "Format complete" but also said "Invalid media or Track 0 bad—disk unusable, format failure."

Several more attempts led me to get a new drive and controller under warranty (Statewide Microelectronics by the way—quick swap; no hassles), but the new set did the *same thing*. Finally, I tried DOS 2.1 again and it runs fine, formatting with no errors. Next, I tried DOS 3.1 with a partition size of 100 cylinders, instead of the 639 on the entire disk, and this worked.

Next I tried "FORMAT C:" with no /s/v, but on the entire disk as DOS partition, and still got the error. Then I ignored the error and did "SYS c:" and copied COMMAND.COM over. Lo and behold, all is fine now! 2K clusters and all! Restored 30 some-odd floppies and all is fine. Does anybody have any idea of what just bit me? Am I hallucinating? Better part of two days makes me want an answer even though it works now.

(continued)

or \$895 with an 80386. Intel offers PLM compilers, assemblers, and other MS-DOS software for 80386 program development. For more information, contact American Computer & Peripheral Inc., 2720 South Croddy Way, Santa Ana, CA 92704, (714) 545-2004. Inquiry 557.

PC-compatible Laptop from STM Electronics

STM Electronics announced the STM Laptop, an IBM PC-compatible portable computer that can be equipped with an expansion unit called the LapMate. The LapMate, which connects to the computer through an interface on the back of the system unit, provides additional disk drives and other expansion options.

The computer runs on a 4.77-MHz 80C88 processor and can accommodate an 8087 math coprocessor. Priced at \$2999, the standard model comes with 256K bytes of RAM (expandable to 640K) and an internal 720K-byte 3½-inch floppy disk drive.

Two display options are available. The electro-luminescent display provides a resolution of 80 columns by 25 lines in text mode and 640 by 200 pixels in graphics mode. The backlit LCD screen offers the same text and graphics resolution. The Laptop also supports an PC-compatible color graphics adapter and includes as standard a parallel and serial port and a mouse port.

A ROM cartridge interface on the computer's back-panel accepts ROM cartridges available from STM or other manufacturers. A ROM cartridge without the ROM is priced at \$39, and a cartridge with 128K bytes of EPROM sells for \$115. The company also offers two op-

The STM Laptop connects to the LapMate expansion unit.

tional ROM sockets for installing up to 256K bytes of applications software.

Among the other options are 384K bytes of internal bubble memory (\$649), an internal 300/1200-bps modem (\$299), two nickel-cadmium battery packs that power the unit for two hours (\$149) or four hours (\$249), a battery pack recharger/adapter (\$19.50), and an AC adapter/charger (\$149).

With a base price of \$549, the LapMate unit contains a 5¼-inch and a 3½-inch floppy disk drive; a hard disk drive is optional. The unit also contains a half-length expansion slot that will accept an RGB adapter (\$209) and has interfaces for an external PC-compatible keyboard, an external monitor, and a connector for additional expansion boxes. According to the company, the computer should be available this month. For more information, contact STM Electronics Corp., 444 Castro St., Mountain View, CA 94041, (415) 968-1790. Inquiry 558.

Atari ST Development System

The Nexus EPROM Development System for the Atari ST consists of

software and a 16-bit external EPROM programmer/simulator that plugs into the ST's cartridge port. The device enables you to program EPROMs of 8K and above and supports data transfer to and from the serial port and disk files in binary, hex-space and Motorola and Intel hex formats.

The unit has two sockets for programming and reading EPROMs, 64K bytes of CMOS simulator RAM, an external simulation socket, and a socket for further expansion. Internal (cartridge) simulation enables the unit's 64K of RAM to be treated as if it were 64K of EPROM. During external simulation, the ST is free for processing other tasks.

The system's software uses the GEM interface and provides windows for displaying RAM or EPROM contents. Its data manipulation features include edit, locate a value, block move, fill/clear RAM, calculate checksums, check for blank and programmable EPROMs, and verify EPROM against RAM.

The development system sells for £175. For more information, contact Nexus Technical Services Ltd., 38 Melrose Ave., Reading, Berkshire RG6 2BN, U.K., tel: (0734) 664559. Inquiry 559.

3D Modeling Package for Mac

Phoenix 3D is a set of Macintosh tools for creating and viewing three-dimensional models. You can design models from all sides, using the mouse to rotate, twist, stretch, bend, explode, and shrink or enlarge the image. You can then view the drawing from any angle. Drawing tools let you remove hidden lines, shade with 64 levels of gray, smooth facets, and filter the resulting image. Drawings can be saved as MacPaint documents. With a conversion utility supplied on the disk, you can import models from other programs.

Models can have as many as 1200 polygons (with as many as 22 sides), spheres, cones, prisms, and surfaces of revolution. The package provides 55 methods of rendering algorithms for building wireframe, hidden-line, flat-shaded, or smooth-shaded models.

The program runs on the 512K Mac, Mac Plus, and Mac XL; supports HFS, Switcher, and Servant; and works with the Imagewriter and LaserWriter. Phoenix 3D costs \$39.95. Contact Dreams of the Phoenix Inc., P.O. Box 10273, Jacksonville, FL 32247, (904) 396-6952. Inquiry 560.

Apple-based System for Handicapped

Point to Pictures is a software/hardware system for persons with IQ levels of 20 to 80 or developmental ages of 6 months to 5 years. R. J. Cooper & Associates says it designed its package, based on research at a school for low-functioning 3- to 22-year-olds, to fulfill three goals: increase educational productivity, stimulate spontaneous

(continued)

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BOOK REVIEWS

guage. Berkeley, CA: Sybex, 1986. \$24.95. 779 pages.

Programming the Macintosh in Assembly Language is a massive book for experienced programmers. Novices would be overwhelmed by the detailed presentation of 68000 chip architecture, instruction sets, and the Macintosh Toolbox.

The presentation of the Macintosh programming environment is the strongest aspect of the book. The discussion of interfacing issues will help you get your own programs working with the Toolbox quickly, using the appropriate screen and mouse features. The book also has copious listings of the source code discussed throughout.

ATARI 520ST TECHNICAL REFERENCES

Editors of *Compute!*. *Compute!'s ST Programmer's Guide*. Greensboro, NC: Compute! Publications, 1986. \$16.95. 356 pages.

One-third of this reference book is a discussion of the Atari 520ST implementation of BASIC. The other two-thirds cover Logo programming, GEM and TOS, and writing GEM applications. As one of the first books on the ST, it attempts to cover as many different audiences as it covers programming topics, for the most part successfully.

Later chapters will be of more interest to advanced programmers due to the discussions of TOS, the GEM desktop, the GEM Virtual Device Interface (VDI), and Application Environment Services (AES). The detail is such that an advanced programmer can learn to write GEM applications in C. But just when you expect the book to discuss application implementation under GEM with C, the book ends. *Compute!'s ST Programmer's Guide* also fails to discuss any aspects of assembly language programming for the ST, another serious drawback to the book's ultimate usefulness.

Szczepanowski, Norbert, and Bernd Gunther. *Atari ST GEM Programmer's Reference*. Grand Rapids, MI: Abacus Software, 1986. \$19.95. 414 pages.

Despite its title, the *Atari ST GEM Programmer's Reference* is really a complete programming handbook for the ST. The book covers much of the same ground as *Compute!'s ST Programmer's Guide*, but it does so in much more detail, with more emphasis on implementing user applications with C.

The bulk of this handbook is taken up with the discussion of GEM's Virtual Device Interface (VDI) and how to use it in your programs to create graphics. A fair number of programming examples are provided to help you implement your own code. Like *Compute!'s ST Programmer's Guide*, this book is dry reading, chock full of assembly language routines and C language definitions, without some more invigorating text to break the monotony.

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68000 Machines

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THE APPLE MACINTOSH GAVE US all a glimpse, back in February of 1984, of a glittering new future for personal computers. Many people had seen similar technology in the high-end workstations made by companies like Xerox, Apollo, and Sun. But these workstations were priced outside the range of the traditional personal computer; we drooled over them but didn't expect to be able to own one—until the Macintosh came along.

Soon after the Macintosh created a new wave of excitement in the personal computer world, Atari and Commodore began showing prototype machines that offered similar capabilities but with more power and at lower cost. Suddenly, it seemed that a new trend in personal computers was developing.

Inspection of the new machines, and many of the workstations they emulated, revealed a common component—a Motorola MC68000-series microprocessor. Closer investigation showed that the MC68000 had the horsepower and the easy programmability that lent itself to the creation of workstation-like machines. These machines had lots of memory, addressed linearly, and handled bit-mapped graphics with ease.

Many people began to see the MC68000 as an alternative to the Intel iAPX86-series microprocessor that powered the IBM PC-class machines. Today, there are avid MC68000 camps and equally avid Intel iAPX86 programmer cadres.

Sparked by all the interest in the new Commodore Amiga, the Atari ST series, and the Macintosh, BYTE began work on an extensive examination of the MC68000. Originally planning for a separate issue of the magazine, we put together a series of articles exploring the MC68000 and many of the machines it powers. Those articles make up this month's theme section and the continuing coverage of the MC68000 that will appear in our Features section over the next several months.

The coverage in the following pages includes a comparison of the entire MC68000 series by Motorola's Tom Johnson. There are, in fact, five different MC68000s, and Johnson explains what each is designed to do and, most important, how compatible they all are with each other.

In other articles, Mike Morton passes along some of the assembly language techniques he's acquired while helping to write software such as Lotus's Jazz for the Macintosh. Adam Webber shares some similar observations about the Macintosh and Amiga system software gleaned from his work in porting the True BASIC language to those two machines. A group of Hewlett-Packard engineers explains why the MC68000 is particularly well suited to the UNIX operating system. Mike Rothman explains the many faces of GEM and the other system software on the Atari ST. And Elaine Ditton and Richard Ditton look at writing animation software for the Amiga, the MC68000-based machine with the most raw computing power but also the rawest system software of the new wunderkind computers.

Follow-on articles in subsequent issues will include articles on debugging in an MC68000 environment, more assembly language programming techniques, and more advanced tutorials on the Atari ST, Amiga, Macintosh, and other MC68000 machines.

—G. Michael Vose, Senior Technical Editor, *Themes*

ATARI ST SOFTWARE DEVELOPMENT

BY MICHAEL ROTHMAN

*A survey of the TOS operating system
that comes with the Atari ST*

THE ATARI ST is one of several recently introduced microcomputers that use the Motorola MC68000 microprocessor. In this article I'll describe the organization of the ST's operating system, called TOS, and show some ways the 68000 influences it. TOS is approximately 200K bytes. Its organization is somewhat confusing because it has three parts that partially overlap in functionality. The two main parts, GEM (Graphics Environment Manager) and XBIOS (Extended BIOS), were originally designed independently and have somewhat different purposes. GEM, a complete operating system developed by Digital Research, is meant to support applications that are portable to other machines (at this writing, GEM has also been implemented on the IBM PC and compatibles).

The Atari-written XBIOS is meant to support ST-specific capabilities not accessible through GEM. For example, the ST's sound chip can be accessed only through the XBIOS. But in some cases, the differences between GEM functions and XBIOS functions are subtle. (For example, GEM and the

XBIOS each have a function to read or write sectors to devices. The XBIOS function assumes the actual ST disk and is knowledgeable about its physical characteristics; the GEM function supports a number of devices that are logically but not physically similar.)

The third part of TOS, the Atari-written Line A Handler, overlaps almost entirely with the graphics routines of GEM—indeed, GEM graphics routines call the Line A Handler to do their work. The Line A Handler will let programmers write faster graphics routines than with GEM.

I've organized this article around the various parts of TOS, which means that you will sometimes encounter similar functionality discussed in two different places. (See figure 1.)

GEM

Most people probably identify GEM with the icons, menus, and windows of the GEM user interface, called the Desktop. The Desktop, however, is not technically part of the operating system. It is an application, automatically invoked by the operating system

after the system boots.

GEM includes the GEM disk operating system (GEMDOS), the GEM Virtual Device Interface (the VDI—a powerful set of graphics routines), and the GEM Application Environment Services (the AES—a selection of special libraries designed to support the distinctive GEM user interface).

GEMDOS

GEMDOS contains the basic input/output system (BIOS), a disk file handler, and a number of functions to support peripheral devices, memory allocation, and the system clock. The BIOS handles low-level character I/O to five different devices: the printer, an auxiliary device (the RS-232C port), the console, a MIDI port for use with music synthesizers, and the keyboard. The routines read or write a single character to these devices or return status information.

(continued)

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The BIOS contains a single routine to read and write to appropriate devices on a sector basis (i.e., floppies, hard disks, networks). Two routines detect whether media in such devices have changed and return a map of the devices actually present.

Another routine returns a pointer to the BIOS parameter block (BPB) for a particular drive. The BPB is a block on the disk containing certain disk parameters, such as the number of bytes per sector or the number of directory entries. It is loaded into RAM when the disk is first accessed. The ST BPB is software-compatible with an MS-DOS BPB, right down to the 16-bit quantities in the BPB, which are written in low-byte, high-byte order—8086 style! (The 68000 orders quantities with the high byte in the lowest memory address.) Using the 8086's ordering of the 16-bit quantities in the BPB was presumably done to make porting GEMDOS from the 8086 to the 68000 easier.

Finally, the BIOS contains a routine to set the 68000's exception vectors in the low end of memory, a routine that returns the system timer value, and a routine to set or get the state of Shift and Control keys on the keyboard and the mouse buttons.

THE FILE HANDLER

GEMDOS supports a hierarchical file system similar to that of MS-DOS. The file-handling functions are

- Create, open, read, write, seek in, close file.
- Get, set file attributes.

- Create, delete, get, or set a sub-directory.
- Get disk free space.
- Directory search, file rename.

THE REST OF GEMDOS

The remaining GEMDOS functions let you

- Handle character I/O on the standard input and output.
- Check the status of a peripheral device.
- Get and set time and date.
- Terminate an application.
- Allocate or deallocate a memory block.

THE VIRTUAL DEVICE INTERFACE

GEM's graphics routines, known collectively as the VDI, provide a systematic way to handle a large number of graphics primitives in a device-independent fashion.

Graphics primitives are drawn by software that is tuned to the particular hardware at hand. The software does not simply move a prestored block of pixel data into memory; instead, it takes a mathematically described notion, like a circle with a diameter x , and calculates what pixels to change. Thus, if the lower-level software is properly written, closely equivalent results can be produced on different devices.

A wide variety of primitives have been defined in the VDI, and you can instruct the software to draw them with various attributes by using the portable VDI routines (the portable portion is sometimes called the

Graphics Device Operating System, or GDOS). A number of device drivers have been written to support the primitives across several devices.

The VDI routines can "think" in either raster coordinates (RC) or normalized device coordinates (NDC). The raster coordinate system corresponds to the actual target's screen resolution. Thus, if you are working on the ST in its highest resolution, 640 by 400, you can call the VDI routines to place and size objects in terms of this resolution. Alternatively, you can use normalized device coordinates, which are always 0 to 32,767 in both directions, and the software will adjust for the particular device. The trade-off for the additional portability is that the software must do a transform on the object being drawn. The NDC space origin also differs from RC space in that it starts in the lower left corner rather than in the upper left corner of the device.

WRITING AN APPLICATION USING THE VDI

The first step in using the VDI is to specify the devices for graphics output. An application must always call the Open Workstation routine for each graphics device that the VDI routines will subsequently manipulate. This function takes an array containing the user's requested defaults for graphics characteristics such as line style, color, character size, fill color, and so on. It is here the developer also specifies the choice of NDC or RC coordinates.

In addition to a device identifier (handle), the routine passes back two large arrays (combined into one in the C language binding) that tell you the device's characteristics (e.g., the number of colors it supports and the size of its pixels in microns) and what VDI functions and attributes it supports.

For convenience, the VDI also provides the ability to open virtual screen workstations so that you can maintain several different sets of default characteristics for the screen device. Each of these workstations is attached to the real screen: Just change which one you specify in your subsequent VDI

(continued)

```
TOS consists of:
  GEM consists of:
    GEMDOS consists of:
      BIOS
      Disk File Handler
      Various System Functions
      Virtual Device Interface (VDI)
      Application Environment Services (AES)
    XBIOS
    Line A Handler
```

Figure 1: Organization of TOS. GEM is an operating system in its own right, written by Digital Research and implemented across other machines such as IBM PCs and compatibles. The XBIOS and Line A Handler parts of TOS were written specifically for the Atari ST and provide faster and in some cases the only access to the capabilities of the ST.

routine, and the defaults will change appropriately.

The VDI functions themselves are too numerous to describe in detail, but most of them can be considered under three headings: graphics primitives, attribute functions, and text functions.

GRAPHICS PRIMITIVES

You can draw graphics primitives, such as a square, a polyline, or a rounded rectangle, after specifying the appropriate attributes for each. Size and endpoints are defined in the chosen coordinate system and passed to the routine. Several of the primitives have their own routines, but most of them are grouped under the Generalized Drawing Primitive function. Primitives can be grouped to form more complex objects, and sophisticated graphics can thus be built.

The primitives supported on the ST are

Polyline: Draws straight lines connecting endpoints defined in an array passed to the routine.

Polymarker: Only the endpoints are drawn, and several different graphics (markers) are available to represent those points.

Text: Note for novice programmers: isn't it nice to know you have been using a graphics primitive all along?

Filled area: The area is a complex polygon, again specified in an input array.

Contour fill: A seed fill.

Generalized Drawing Primitive: The GDP is a single entry point for the following primitives: bar, circle, arc, pie, ellipse, elliptical arc, elliptical pie, rounded rectangle, and filled rounded rectangle. If you are programming in C with the Atari-supplied developer's package, these are bound as separate functions.

Justified text: Can be justified left or right.

ATTRIBUTE FUNCTIONS

The attribute functions of the VDI manipulate characteristics of the graphics primitives. The developer can set color for both fills and lines. The polyline width is variable, as are the type of line (e.g., dashes or dots can

be substituted for a solid line) and the end type (arrow, squared, or rounded). The polymarker function, which essentially lets you draw a connect-the-dots figure, is supported by an attribute function to change the type of "dot" or marker.

One of the most important attributes that can be set is the writing mode. This determines the relationship of a new image to the raster area it overlays. When you draw a new graphic, whatever the method, you can think of it as a mask of 1s and 0s laid over the display. Each corresponding pixel on the device will be affected. In the simplest case (the replace mode), each pixel under a 1 on the mask is set to the currently selected color for that type of primitive, and each pixel under a 0 is set to the current background color. But the developer can also choose one of three other modes. In transparent mode, only the pixels under 1s are changed. In reverse transparent, only the pixels under 0s are changed. And in XOR mode the mask value is exclusive-ORed with the value on the display. (Twelve additional modes are available through the Line A Handler, described below.)

All the attribute functions take effect for all subsequent relevant graphic operations, until the developer changes the attributes once again.

TEXT FUNCTIONS

The VDI provides two ways to handle text. One is an Alpha mode with its own set of functions, which on the ST implements an 80-column by 25-row text mode (in high and medium resolution). Alpha mode is not compatible with most of the other VDI functions; that is, you cannot display other graphics with text in this mode.

Much more interesting is text handling within the normal graphics mode, where text and graphics can be completely intermixed. The VDI supports two basic text output functions (regular and justified) and a sophisticated set of attributes, including multiple fonts (two are built into the ST, more have been developed by third parties). The developer can change the character height absolutely (in terms of the chosen graphics coordi-

nate system) or in "points," the system used in print shops. The baseline of the character can be set at various angles (thus allowing rotated characters—on the ST, only multiples of 90-degree rotation are supported). And the characters can be thickened, skewed, underlined, outlined, or shadowed. In addition, text attributes include the standard VDI characteristics such as color and write mode.

THE GEM APPLICATION ENVIRONMENT SERVICES

The AES is an umbrella name for several libraries of routines, most of which implement various data abstractions for the developer. That is, some of these "services" gather together functionality available elsewhere in GEM to express useful concepts, such as windows or events.

But the AES also includes the part of GEM that manages the interaction between application and certain system capabilities that run concurrently. As a developer, you rarely need to think about this limited multitasking, precisely because it is limited and exists mainly to service system needs. Those needs are the desk accessories and the Screen Manager.

GEM supports several desk accessories: tasks that are selected by the user from drop-down menus, each of which occupies its own window. It also supports the Screen Manager, an application that runs concurrently with whatever else is going on and monitors user interaction with the menus and window borders.

The AES functions also comprise an event library, a window manager, several libraries for managing certain graphic data structures, a scrap library, a shell library, and a resource library.

THE EVENT LIBRARY

Macintosh developers will be familiar with the concept of an event manager. On that machine, the ideal program is seen as a loop. During each pass through the loop, the Mac waits for any one of several "events" specified by the developer, usually keyboard activity or mouse movement/selection, responds appropriately, and

(continued)

then goes to the top of the loop.

Although GEM is much less radically tied to a particular programming style, the event library has a similar function on the ST. At any point in your program, you can specify an event or events you are interested in waiting for, and the multitasking dispatcher will suspend your application until one of those events occurs. The events included could be a simple keystroke or perhaps the straying of the mouse cursor into and out of a rectangle defined by your application.

Giving your program the information it needs to do its part is the job of the message events. To wait for certain events, you call a routine specific to the event in question. For more complex events, particularly those concerning user interaction with screen windows, you call a routine that waits for a "message" from the AES. A message is a multibyte code that is placed in a buffer whose address you pass to the routine. Pre-

defined system messages tell you, for example, that the user has taken an action that necessitates redrawing part of one of your windows. (For example, the user has moved a window that was partially covering a second window. The second window is now more exposed, and the newly exposed area should be redrawn.)

THE WINDOW LIBRARY

To quote the GEM documentation, "A window is an area with clearly defined boundaries." Anyone who has worked with the Macintosh or one of the user interfaces that mimic it will be comfortable with the GEM window concepts, which (as of this writing) included the familiar title bar, close box, scroll bars, and size box. The creation, care, and feeding of windows is handled by the routines in the window library. In general, the GEM division of responsibility for the user interface is that the developer is expected to handle and update the work area in-

side a window's frame while GEM handles the drawing and updating of the frame itself, including, for example, the scroll bars, the title bar, etc. [Editor's note: A program that illustrates a fair amount of window work is available, along with the two listings printed in this article, in a variety of formats. See the insert card following page 368 for details.]

LIBRARIES TO SUPPORT THE USER INTERFACE

The AES contains a number of routines concerned with manipulating various graphic data structures that your application can use for a standard user interface. For example, the File Selector Library provides a standard dialog box that lists the files on a disk device and allows you to select one. The Graphics Library is concerned mainly with drawing boxes on the screen. For example, it will draw an expanding box outline that your application can use to make a window or other rectangular object appear to



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grow quickly out of some other object. This is what the Desktop does when you click on a disk icon and it "grows" into the disk's file window.

The Object Library is a macro facility that lets you create complicated graphic structures and link them in a single "object tree." For example, say you want to display a small rectangular box within a somewhat larger box on the screen and you also want to place text in the smaller box. You can do all this by calling the appropriate VDI graphics primitives. But alternatively, you can use the Object Library of the AES, which will let you define the whole thing in a well-documented tree structure. This has the advantage that the entire tree can be repeatedly drawn and reused in the application with only a single call each time. Furthermore, you can specify that only certain levels within the tree will be drawn.

The routines in the library support the construction of the tree and the

reordering or deleting of its nodes. The library also offers various kinds of user interaction with on-screen objects, such as a routine that will tell you what object is currently under the mouse cursor and another one that lets you edit text in an object.

The Form Library uses object trees to implement more sophisticated user interactions. A form is an object tree designed for user input. A good pre-defined example of an object tree is the simple form that appears on the Desktop if the user decides to format a disk. The form is a box containing text that asks the user to confirm the format request and two small boxes containing the words O.K. and Cancel. (Boxes of this sort that contain mutually exclusive options are called "radio buttons.")

To use a form, the program calls the basic form routine, with an index of the desired object tree as argument. The AES takes over until the user selects an object that the developer

has defined as an "exit object" (such as the O.K. or Cancel boxes in our example). Until that time, the AES handles the user's input, which can be of three types: the radio buttons, "check boxes"—boxes containing options that are not mutually exclusive, or text. On exit from the form routine, the application can examine the form to see what changes have taken place.

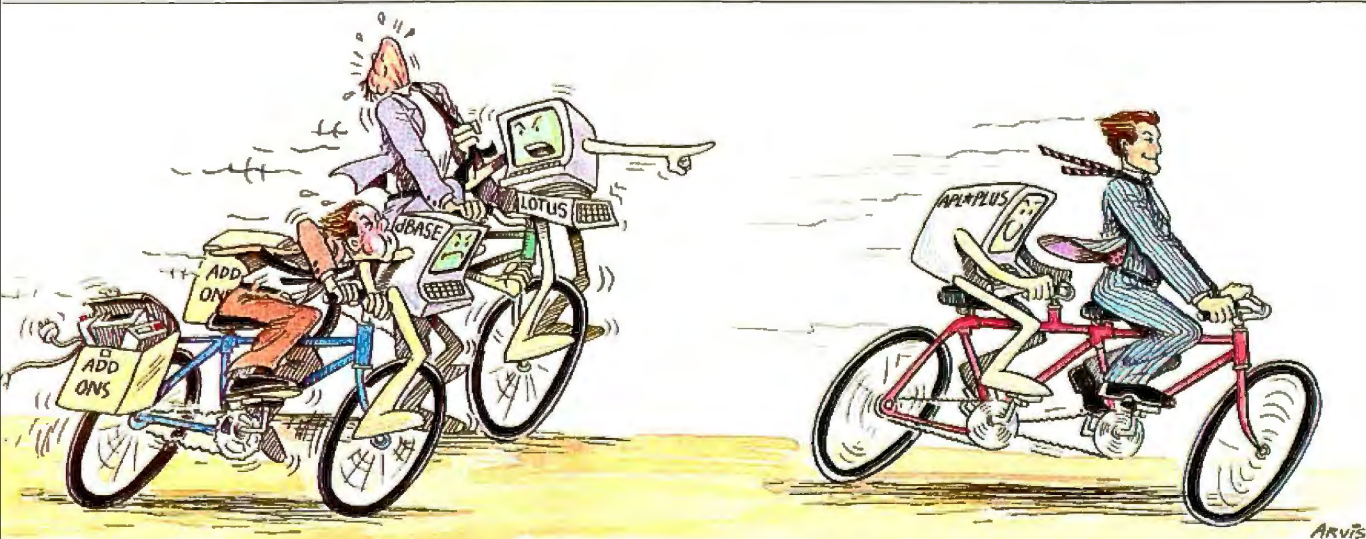
THE RESOURCE LIBRARY

Applications can share objects and object trees between applications or keep them conveniently modular through use of the Resource Library. For developers, Atari provides the Resource Construction Set, which allows on-screen construction of objects and other types of resources.

THE SCRAP LIBRARY

The Scrap Library allows developers to share certain kinds of data among applications. It supports the AES im-

(continued)



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Listing 1: This is a routine to format a floppy disk on the ST. If the formatting is successful, the routine will return a 0.

```

/* #define DEBUG 1 */
#include <osbind.h>          /* C bindings for OS routines */

#define HITRACK 79           /* Highest numbered track */
#define SECTORS 9            /* Sectors per track */
#define MAGIC 0x87654321L    /* Required by Flopfmt() */
#define VIRGIN 0xE5E5        /* Pattern to write to sectors */
#define ILEAVE 1             /* Interleave factor */
#define DISKTYPE 2           /* Single side, 80 track */
#define NOLOAD 0             /* No loader code */
#define RANDOM 0x1000000L    /* Protobt makes a random */
#define BOOTSECT 1           /* Side 0, sector 1 */
#define TRACK0 0             /* Track for boot sector */
#define SIDE0 0              /* Format side 0 */

extern void errprint(); /* error notification routine */

format(devno)
int devno;              /* device holding media to format */
{
    /* Automatic variables */
    /* count tracks */
    register int i;
    /* buffer for track, protoboot */
    register char *buf;
    /* success in format? */
    register int succ, totsucc = 0;
    /* doesn't do anything */
    long filler;

    /* Code */
    /* Allocate memory for track. The ST formats one track at
    a time and requires sufficient RAM to verify that track in
    memory. Malloc is a GEMDOS call. */
    buf = Malloc(8192L);
    if (buf == 0L)
    {
        #ifdef DEBUG
            errprint(0, "Insuff memory for format");
        #endif
        return(-1);
    }

    /* Format each track. VIRGIN is the value to write to the
    newly formatted track. This particular value (0xE5E5) is
    suggested in the documentation, but many values are
    possible. Flopfmt is XBIOS. */
    for (i=HITRACK; i>=0; i--)
    {
        succ = Flopfmt(buf, filler, devno, SECTORS,
            i, SIDE0, ILEAVE, MAGIC, VIRGIN);
        totsucc += succ;
    }

    /* Release memory. GEMDOS */
    Mfree(buf);

    /* For the purposes of this routine, I won't accept any bad
    sectors. But, if there were any, their numbers would have
    been left in the buffer after each track was formatted.
    Alternatively, I could have retried or recorded the bad
    sectors if I were developing my own file system. */
}

```

(continued)

plementation of several standard data types. If you use these, your application can exchange information with other applications through a cut-and-paste mechanism.

THE SHELL LIBRARY

The Shell Library contains routines to allow the chaining of applications.

THE EXTENDED BIOS

The XBIOS provides more direct access to the ST's hardware than anything in GEM (which, after all, has to be portable). The XBIOS provides functions to read, write, verify, and format the floppy disks on a sector basis. Unlike the BIOS read/write function, these are not device-independent but are designed for the floppy disk drives only. They work for single- or double-sided drives. The format routine gives the caller specific information on bad sectors. Listing 1 is a routine to format an entire disk.

SCREEN PARAMETERS

The XBIOS also handles various video screen parameters. The ST screen memory occupies 32K bytes in memory. Initially, the physical screen base address is set to the top 32K bytes of memory, but the XBIOS has a routine to set that base on any 256-byte boundary. You can also set a logical base that the GEM and Line A graphics routines will use as their understanding of where the screen memory begins. Other routines let you set the screen resolution to one of three values:

640 by 400 pixels, monochrome
 640 by 200 pixels, 4 colors
 320 by 200 pixels, 16 colors

TOS knows what kind of monitor is attached to the system and will refuse to set the monochrome resolution if the color monitor is attached, or vice versa.

Two other XBIOS routines let you set the ST's palette. The palette has 16 entries. Three bits of information are stored for each entry for each of the three primary colors, red, green, and blue. Therefore, the lowest and highest values for each palette entry are (in octal) 0 and 777. In other

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ATARI ST SOFTWARE

```

if (totsucc != 0)
{
#ifdef DEBUG
errprint(totsucc, "format failed");
#endif
return(-1);
}

/* Now we need to put a boot sector on the disk. */
/* Allocate a 512-byte buffer */
buf = Malloc(512L);

/* Prototype a boot sector in that buffer. The second
parameter is a serial number for the disk. The value I
have chosen asks the XBIOS to generate a random number.
XBIOS */
Protobt(buf, RANDOM, DISKTYPE, NOLOAD);
/* Write out the boot buffer to track 0, side 0. Last
parameter is how many sectors to write. */
succ =
Flopwr(buf, filler, SIDENO, BOOTSECT, TRACK0, SIDE0, 1);
/* Throw away memory */
Mfree(buf);

/* Return success or failure */
return (succ);
}

```

words, your 16 colors can be selected from a total of 512.

SOUND

Four routines in the XBIOS manipulate the ST's sound chip, which is the Yamaha Programmable Sound Generator (PSG) YM2149. The sound chip has two general-purpose I/O ports, which the BIOS uses for both floppy selection and some serial port functions; two of the routines are concerned solely with setting bits in one of these ports.

The chip has three sound channels and 16 registers. The third routine lets you set the registers to select

- The frequency for each channel.
- The volume for each channel.
- Either white noise or pure tone for each channel, or a combination.
- One of 16 envelope shapes.
- The frequency with which the envelope is applied to the basic sound waveform.

The last two points are of some interest: Although the PSG cannot manipulate the components of a sound envelope directly (i.e., the attack, decay, sustain, and release values), the ability to switch between different preset envelope shapes and manipulate their frequency gives you the ability to produce unusual sounds.

The final sound routine, dosound(), gives you access to a mini control language for the sound chip that is implemented in the TOS software. By developing a list of commands, you can set any register on the chip, specify a sequence of tones, volume changes, envelopes, or any of the other parameters available through the chip. The dosound() routine sets a pointer to an area of RAM where you have placed such a list of sound commands. The software takes over and runs your commands at 50-Hz intervals (actually every fourth instance of a 200-Hz interrupt that is set up off the 68901 timer chip and used by TOS for a number of functions). One of the commands allows you to specify how many ticks should go by until the next command is executed.

THE LINE A ROUTINES

The Line A Handler is not part of GEM but the result of Atari's realization that it could provide faster access to some of the routines that support the GEM VDI. These routines are assumed to be used from the assembly language level. They are known collectively as the Line A Handler because access is through the 68000's unimplemented instruction exception handling. The 68000 recog-

(continued)

nizes op codes beginning with the bits 1010 (hexadecimal A) as unimplemented instructions and jumps through a special exception vector, which in the ST points to these routines.

Because they were not originally intended for public access, use of these routines is not as easy or as consistent as is the case with the other entry points. Basic usage involves setting some of the values in a large data structure and then kicking off the Line A exception handler by defining a word op code whose first 4 bits are 1010 and whose last 4 bits specify which routine is desired.

The Line A routines give you faster access to graphics using the VDI and a few additional features, including a sprite facility and the ability to apply additional logical changes to raster objects while copying them from one place to another. You can mix and match Line A Handler and VDI routines, but this can be a little tricky,

since your Line A variables may be affected by your VDI calls.

There are 16 Line A routines:

- 0 Initialization
- 1 Put Pixel
- 2 Get Pixel
- 3 Line
- 4 Horizontal Line
- 5 Filled Rectangle
- 6 Line-by-Line Filled Polygon
- 7 BitBlt
- 8 TextBlt
- 9 Show Mouse
- 10 Hide Mouse
- 11 Transform Mouse
- 12 Undraw Sprite
- 13 Draw Sprite
- 14 Copy Raster Form
- 15 Seedfill

About half of the Line A routines are concerned with graphics primitives similar to those in the VDI. The mouse manipulation functions are fairly boring and obvious. (Transform Mouse sounds neater than it is—it just

changes the cursor representing the mouse position.) Let's take a closer look at the other routines.

BIT BLTING (ROUTINES 7 AND 14)

Raster operations involve a rectangular area of the raster, or video screen image. You often want to put a rectangular image (a bit-mapped object) on the screen and define the relationship it will have with the image that is already there "under" the rectangle being placed on the screen. For example, you may wish to say that certain pixels in the object are to be treated as transparent: Whatever is "below" them on the screen will not be changed and will therefore "show through" the new rectangle.

Additionally, you would like to be able to set the new rectangle down at an arbitrary coordinate on the screen. Unfortunately, many schemes for representing an image in memory are

(continued)



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Listing 2: This trap handler is the sort you might use if you were programming the ST in 68000 assembly language or were using a high-level language and needed to write a binding for access to a BIOS, XBIOS, or GEMDOS function. The functions assume the C calling conventions; that is, if there are any parameters, they are assumed to have been pushed onto the stack in reverse order and to be no smaller than a word. The number of the routine itself must be pushed last, just before the trap call. If you are developing using the C provided in Atari's developer's kit, this process will be transparent, since a set of bindings is available that makes TOS calls look just like ordinary C function calls.

```
; At entry, any arguments for the function have been pushed
; on the stack in reverse order, C-style. Then the
; function number was pushed. Finally this routine was
; called, so as you enter, the return address of the caller
; is on top of the stack.
```

```
retsv: ds.l           ; some memory for a long variable
```

```
traprtn:
  move.l (a7)+, retsv ; Save the return address,
                      ; because the OS functions don't
                      ; expect it.
  trap      #13       ; Trap to the BIOS function. (BIOS
                      ; is available through trap 13,
                      ; XBIOS through 14, GEMDOS through
                      ; trap 1.)
  move.l retsv, -(a7) ; Put the return address back on
                      ; stack.
  rts               ; Return to caller.
```

often constructed for the hardware's convenience. The ST's screen memory, for example, consists of a word's worth of one plane of information, followed by a word of the next plane, and so forth, until 16 pixels for each plane have been defined. Then you start again with the first plane.

To simplify the job of manipulating the screen memory on the ST, a bit blter (bit-mapped block transfer) is provided. A bit blter can be software or firmware or both to support logical raster operations. On the ST, in the VDI and the Line A routines, a moderately complex data structure known as a memory form lets you define a raster and a rectangle within the raster so that the blter can manipulate it. One item in the form is a pointer to the actual image data. The rest of the fields specify things like the number of planes and the size of the rectangle. You need two of these memory forms for your bit-blt'ing operations: one for the source raster and one for the destination.

An intriguing aspect of the memory form is the specification of the total raster representation that your object

is part of. This may be the actual screen memory if the bit-mapped object is currently on the screen. But it can also be a virtual screen of any size (word-aligned in the x dimension) up to that of a real screen. Probably the most common bit-blt operation copies from a source memory form with a virtual screen just big enough to hold the bit-mapped object, to a destination memory form pointing at the real screen. But for arcade-style applications in particular, many more complicated arrangements can be imagined: for example, blt'ing from various game objects to an entire virtual screen being prepared for display. And you can blt from one part of the screen to another.

The Line A BitBlt is sophisticated. There are 16 logical operations you can apply between the source and destination. If you define a pattern, you can perform a logical AND of the pattern with the source and combine the result with the destination.

SPRITES (ROUTINES 12 AND 13)

These sprites are not spectacular, and they're not in hardware. But they are

convenient, and you can have as many as you want. The Line A sprites are two-color (foreground/background). They are 16 pixels wide and 16 lines high. A sprite can be plotted onto the screen relative to any one of its pixels. When you call Draw Sprite, you specify a buffer to save the screen area covered by the sprite; when you undraw, the routine can restore the screen. Nothing to write home about, but nice nonetheless.

WHAT DO YOU USE?

What is the place of the varied pieces of TOS in a typical application? Well, if you are willing to stick to GEM, you can access most of the ST's power. And you have the advantage of programming for a consistent virtual machine with a well-documented graphics model and a well-known user interface. Also, you will have an application that is portable to other systems supporting GEM. The non-GEM pieces give you more direct access to the ST hardware. And in some cases (such as sound), they give you the only access.

There are no restrictions on the developer who wants to mix and match. The VDI and AES functions on the ST are accessed through libraries of glue routines that you link with your application. Entry to the BIOS, XBIOS, and GEMDOS routines is actually achieved through the 68000's trap handlers (see listing 2). If you develop in C, bindings are available so that access to any TOS routine is simply a function call.

I have enjoyed software development on the Atari ST. I suspect my pleasure has something to do with the ST's peculiar combination of operating system routines. There are just enough traditional concepts to stave off the programmer's fear of coming obsolescence and just enough exciting new concepts to challenge creativity. Development has a clean, modular feel to it. The abstractions available in the operating system, particularly in GEM, are clear and consistent. These abstractions don't force you in any particular direction; if what you really want is to make the ST look like an old-fashioned, user-hostile machine, you can do it. ■



A BUSY DAY

BY JERRY POURNELLE

A long day is representative of what Jerry's month was like

It has been a day. I'll explain.

I was on the road most of last month, and this one wasn't much different. Some time ago I accepted an engagement to speak at the U.S. Navy's Micro Convention—more on that later—and every year I go to the annual meeting of the American Association for the Advancement of Science. When Tom Clancy, author of the successful *Hunt for Red October*, heard I was going to be out his way, he arranged for me to go with him to the Navy's flight center at Patuxent River in Maryland, where we got to climb around in the latest aircraft. I wouldn't have missed that for worlds, but it used up two more days.

The Navy Micro Convention was in Virginia Beach. That isn't quite the end of the earth, but on a clear day you can probably *see* the end of the world from there. Returning involved flying with Agony Airlines out of Norfolk. I had two days at home, then we were off to Philadelphia for the AAAS. While I was here I worked on the final edit of *Legacy of Heorot* and left it for Larry Niven to finish. I also worked all night on the final report of the Citizen's Advisory Council on National Space Policy, since it had to be in Washington before the first of June.

I came back to find galley proofs of the new release of *The Mercenary*, most but not all of *Heorot* done, a zillion BIX messages about the Council report, an Atari 1040ST, the usual four tons of software, and 28 telephone messages. One was from our editors at Simon and Schuster: they wanted the final manuscript of *Heorot* right away. So did my agent, who was traveling to England and had a really good offer for British rights, only he'd have to take a manuscript with him. Another was from Ken Sheldon, my long-

suffering BYTE editor, who really would like to know when he'd get this column (already two weeks late).

Heorot existed—more or less—on disk, but what was needed was paper copies. Some day, I hope, that won't be necessary. I ought to be able to deliver books on disk or by telephone. Alas, not yet: I'd have to print the book out, and *now*.

It was clearly time to use every bit of computer power available.

SPELLING, ANYONE?

It wasn't easy, but I got everything done in one day.

First things first: our manuscript had never been through a spelling checker. You might think that with three authors—Larry Niven, Jerry Pournelle, and Steven Barnes—all working with computers to produce this book, there wouldn't be many errors. One of the great things about writing with little computers is that you can not only write faster, you can write *better*, since it's so very much easier to make changes. Given the rush, surely we could leave the rest to copy editors?

I suppose we could have, but Larry and I have had sad experiences with copy editors who not only didn't catch the real mistakes but decided they could write better sentences than we can. We have developed the theory that the fewer genuine errors, the less incentive for the copy editor to make needless changes; which means that *everything* goes through the spelling checker, even if it's a 565-page manu-

script that has to be printed and ready for Federal Express in one day.

First thing, then, was to fire up the Golem, our big CompuPro 286/Z80 machine. The Golem has 2 megabytes of M-Drive/H RAM disk mem-

ory; more than enough to hold all of *Heorot* as well as The Word Plus complete with dictionaries. Since a good part of a spelling program's activity involves long searches through files, a RAM disk speeds things up something wonderful.

The Word Plus allows you to use multiple dictionaries: the main dictionary, an update dictionary, and a special dictionary that can be dedicated to this particular manuscript. The update dictionary is needed because you can't add words to the program's main word list; that's encoded to allow very fast searching. The special dictionary is great because I can fill it with stuff unique to this book: character names, slang expressions, and stuff like that.

When I was ready to begin, I turned on Big Kat, the Kaypro 286i. While the Golem was working on the text files, I used Big Kat to connect to BIX and clean up some of my BIX mail. Of course, this was clearly the wrong day to quit using Crosstalk; that is, I'd intended to check out Mirror, the Crosstalk clone program, but I sure wasn't about to do *that* in the middle of a crisis.

It all worked quite well. *Heorot* is organized into 34 chapters of about 20K bytes each. It took The Word Plus a little more than a minute to read a chapter, make a list of unique words,

(continued)

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future.

I didn't have the foggiest notion of what to do next. I'd never had trouble with the Printer Optimizer.

sort them, and check them against the three dictionaries in use. During that minute I could answer a BIX mail inquiry or read a couple of items in a conference. Then I'd turn back to the Golem and deal with the spelling situation.

The early chapters took more attention, of course, since I started with a blank special dictionary. I had to build it up, adding character and place names and slang. Even so, I found I could get a chapter done in five minutes, one of which I'd spent on BIX.

Once I had ten chapters done it was time to print.

CRITICAL JOB DETECTOR

When we designed my new offices, we included a small soundproofed room with its own air conditioning. I was tired of being in the same room with a machine gun; the printers would lurk in their own special place. It would be inconvenient to have printers at a distance, but it sure would be quieter.

By the time we were actually building, though, I had the HP LaserJet printer; and it's so quiet that there's no need to put it elsewhere. It does generate a bit of heat, but fans take care of that.

The LaserJet is normally connected to Big Kat and to Zeke II, the ancient CompuPro Z80 I write all my books on. Actually, neither machine is connected to the printer: they both connect to the Printer Optimizer, which is a box full of memory that connects to Big Kat by a parallel port and to Zeke II by a serial port. It's very handy: whichever computer is sending, the

Optimizer catches what's being sent and puts it off into the LaserJet. The Optimizer can also translate various print formats into stuff the LaserJet understands; if you have a LaserJet, you probably ought to have an Optimizer.

However, the Optimizer, like most electronic equipment, is apparently furnished with a "critical job detector." I say this because I've had that Optimizer for more than a year now and *never* had one iota of trouble with it; but today was different.

My plan was to connect the Golem to the Optimizer. This is simple enough: I just get an RS-232C cable (I buy mine from Inmac, a pricey but reliable mail-order supply house) and run it across the floor. The Golem isn't normally connected to any printer. Once a month I roll the NEC Spinwriter out to write checks because the LaserJet doesn't take tractor feed, but normally the Golem's jobs don't include printing. If I really need for him to produce hard copy, it's easy enough to string the cable; both Zeke II and the Golem talk to the Optimizer at 9600 baud with the same handshaking protocols and such, so I just unplug Zeke's cable and plug in the Golem's.

Having connected the cable, it was time for a test: the Golem runs under Concurrent CP/M. Do a Control-P and type a couple of characters to be sure things worked right—

And the Optimizer began to squeal.

The first rule is Don't Panic. Machines know when you're scared. It's that "critical job detector" circuit. Work carefully. . .

Maybe I'd connected something up wrong. Better test it; but first, go over to Big Kat and do a "print screen" just to be sure the Optimizer and the LaserJet are working.

More squeals. The Optimizer just wasn't going to accept input.

I didn't have the foggiest notion of what to do next. I'd never had trouble with the Optimizer. Of course, I'd never had such a critical job before.

"Usually," I told myself, "usually it's a cable." Check all cables. No luck, of course. Next, look at everything very calmly and carefully—aha. Normally the Optimizer's little LED display

blinks to tell you whether it wants to print serial or parallel (it can be connected to two different printers as well as two computers). It wasn't blinking. It wasn't doing anything.

Hmm. Time to open it up and look inside. That's easy enough. Now push down all boards and tap all chips. No luck. Then I noticed: the Optimizer has a small lithium battery. This lets it remember what it's supposed to do even when you've turned off the power. The Optimizer seemed to have forgotten something. Could that be it? If that battery is dead I'm in real trouble, but suppose the contacts to it are corroded? Worth a try, anyway. I rotated the battery in its holder, then reprogrammed the Optimizer.

Voilà! Suddenly everything worked fine. Screen dump came through. Connect the Golem, do a Control-P; works fine.

The moral of the story is that if you're very, very careful and stay very, very calm, you can defeat the critical job detector.

AN ORGY OF PRINTING

From there on things were easy. I had one more glitch: I'd never put a version of WRITE configured for the HP LaserJet onto the Golem. Attempting to print to a LaserJet with a program that thinks it's talking to an NEC Spinwriter will produce interesting results: it fills the LaserJet with form feeds, so that even if you halt input into the printer you'll get a dozen or so sheets of paper with one or two lines of garbage. The only way I've found to stop things when they get that far is to turn the LaserJet off, which usually results in a paper jam. Fortunately, paper jams are easy to clear.

Installing a new version of WRITE took less than five minutes. After that it was a piece of cake. At eight pages a minute the LaserJet can print a chapter about as fast as I can check the spelling, so after I sent over the ten chapters I'd already done, things went very smoothly. You do have to keep the LaserJet's paper tray filled, and that has to be done at its convenience: if you try to add paper while it's printing, you get a paper jam. The good news is that the LaserJet remem-

(continued)

bers which page it messed up in the paper jam and does that page again once you have the paper tray filled and the jam cleared.

By this time I'd caught up with most of the BIX mail, and the special dictionary for *Heorot* was doing a lot of the work, so that I could check a chapter's spelling in four minutes or so, meaning that I could now relax a bit. I thought of firing up Zeke II and beginning this column, but I didn't.

What I did manage was to get one copy of *Heorot* done in time for Federal Express to come get it. The spelling check was worth it, too: there were 6 to 10 errors per chapter, including inconsistent spelling of character names, and once a character apparently changed sex without an operation, or would have if The Word Plus hadn't caught it.

So. That's done. Now to do the column.

WORD PROBLEMS

Of all the spelling checkers I've used, I like The Word Plus best; but it does have some problems. For one thing, it doesn't know any plurals, and it doesn't know the full conjugations of most verbs: it knows "analyze" but not "analyzes" and "dog" but not "dogs." By now I've put most of those into the update dictionary, but it can be annoying while you're building it.

There are also bugs in the dictionary. The worst one is that any word that contains the root "cen" will be reported as wrong; somehow Oasis got "cei" in there as the root, so The Word Plus believes "ceitered" is correct but not "centered." I've found a couple of other odd anomalies like that. Once in a while, too, The Word Plus wants to run two dictionary words together, which makes no sense.

For all that, The Word Plus is fast. It can find suggested words quickly, and it's very responsive to user control. I wish Oasis would update the main dictionary, but whether that happens or not, The Word Plus is the spelling-check program I recommend.

SPRING COMDEX

The Spring Computer Dealers Exposition, better known as COMDEX, hap-

pens in Atlanta. Every year I say I'm not going, but I always do, lest I fall even further behind. Of course, keeping up in this crazy business is impossible, just as it's impossible to see everything at a COMDEX. I hope I didn't miss anything important, but I probably did.

From what I did see, four products stood out. First, Sayette Technology (an Eastman Kodak company) has a wonderful gadget called the Sayette System 10. It's a transparent gizmo about the size of a loose-leaf notebook. You lay it on top of your ViewGraph overhead projector and run cables to your IBM PC-compatible computer. Now anything that appears on the PC screen will get projected onto the ViewGraph screen.

There are limits. No color, to start. On the other hand, it will translate color output into 16 shades of monochrome, so this isn't a severe handicap.

Many places, such as the civil engineering department at the U.S. Air Force Academy, have developed really nifty software that can be used to demonstrate engineering and science principles. Up to now, projectors that could handle computer output have been very costly, so most schools couldn't afford one. Students either have to huddle around a computer screen or take the instructor's word for what's happening. The new Eastman projector will change all that. At present it sells for less than a thousand dollars. I expect that price to fall. I also expect to see some kind of adapter for the Macintosh, after which this thing is going to have a real impact on education.

AT&T PC 6300 PLUS

My second pick of the show is the AT&T PC 6300 Plus.

I don't know what to do about AT&T. The company has really great technological capabilities. I freely confess to being a Bell Labs fan. Moreover, AT&T is one of the few companies with both the finances and the technical resources to be real competition to IBM, something this industry sorely needs.

With all that going for them, AT&T needs only one hit in the small com-

puter market. The company may have it with the 6300 Plus, which is a 98 percent PC AT-compatible box that happens to be faster than an AT and also happens to speak UNIX. More than that, the 6300 Plus can run one job under MS-DOS and simultaneously do UNIX tasks. It's also a rather handsome piece of equipment, with a sensible design, unlike the AT&T PC 7300 (now called the UNIX PC), which takes an acre of desk space and has a keyboard cable coiled so tightly it can drag the desk to your chair.

The 6300 Plus I saw had terrific graphics. Text on the color screen was large, clear, and as steady as anything I've seen in monochrome.

In a word, I was impressed.

The AT&T people said they'd get me a 6300 Plus, and I confess I'm rather eager. Certainly it could take the place of Big Kat, and it could possibly become the main machine here.

That's the plus side.

On the minus side, AT&T could take marketing lessons from just about anybody, including some companies in Chapter 11. That isn't just in the computer field, either. As I was writing this, I got what must have been my tenth call from AT&T urging me to choose them as my long-distance carrier. The only problem is that I *already* chose them. Both by mail and every time they called before. I'm afraid I screamed at the poor chap on the phone. I also told him that the next time AT&T calls me, I'm going to change to anyone *but* them. Think that will work?

AT&T does believe in telephones. They believe so much that they don't put addresses on their press releases. They do give phone numbers, of course, both office and what they say is the home number of their press officer. Calling that after business hours gets an answering machine. I wonder: do they figure people will call for an address? And do they need the business?

ATARI ST

My third pick of the show was the Atari ST; the software base for this machine continues to grow, and it's now quite clear not only that Atari will sell a lot of them but that the third-

CHAOS MANOR

party support base is growing.

For example, Mind Mine Computer Center has kits to upgrade the 520ST to a full megabyte and also to install a permanent battery-backed clock/calendar. Installing the calendar requires pulling a chip and inserting it into a piggyback board. The instructions are clear, and anyone but a certified klutz could do it. The memory expansion is a bit more difficult and requires soldering. Mind Mine warns that it's no job for a novice. I agree, but the instructions are very clear, and it's a lot easier to use their kit than to expand the 520ST by piggybacking chips, as many have done. With those provisos, I recommend both boards and look forward to Mind Mine's future efforts.

Another Atari product I have no trouble recommending is Zoomracks from Quickview Systems. Zoomracks was written by Paul Heckel, the author of *Elements of Friendly Software Design* (Warner Books, 1984), which was my book of the month a year or so ago. It's a kind of database program that's the simplest thing in the world to use. Remember a few years ago when the Execuscan Scan Card systems were all the management rage? I sure do; I bought several of them and even gave a few as presents. Alas, like most such organization schemes, the paperwork was too much, and my leatherbound Execuscan systems languish on bookshelves. Zoomracks, though, is very like Execuscan except that it's computerized, meaning that it's very simple to set up racks of "cards," label the racks, and put whatever you like on the cards. It really works on the Atari. There's a version for the IBM PC, too; it's a bit slow, but fast enough on an AT. With that reservation, very much recommended. You'll hear more about Zoomracks in the future.

More Atari software: a ton of stuff from Antic Software, ranging from some of the most absurd joke programs to Maps and Legends, which has lots of maps and map-drawing tools. Antic specializes in low-cost software that comes without manuals. Alas, they've also set things up so that most of their help files have to be printed out, and I don't have a printer

(continued)

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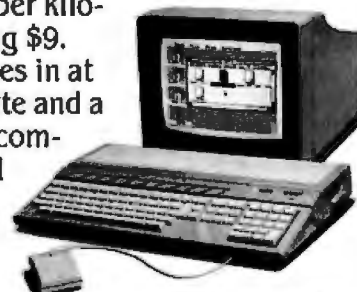
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To give you an idea of what an extraordinary accomplishment that is, let's look at the price-per-kilobyte figures for some well-known competitors.

The Macintosh™, for example, comes in at over \$4 per kilobyte, the Amiga™ is over \$5 per kilobyte and the PC AT™ is a whopping \$9.

In contrast, the 1040ST comes in at an incredible 98 cents per kilobyte and a total price of just \$999⁹⁵ for the complete system: CPU, disk drive and high-resolution monochrome monitor.

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assigned to the Atari just now. On the other hand, much of their stuff is self-explanatory.

I could go on, but surely the point is clear: Atari ST software pours forth like a flood. The Atari is here to stay and delivers more computer power for the buck than anything else that I know of.

AMIGA

My top pick of Spring COMDEX was the Amiga.

The Amiga did have some problems. For instance, when Ken Sheldon and I approached the Atari booth, they practically ran out to grab us; I stood in the Amiga booth for 15 minutes before anyone spoke to me. Atari software was demonstrated by hackers; most of the Amiga software was demonstrated by clerical employees from Commodore headquarters.

None of that really mattered. What was important was that the Amiga booth was jammed. I could feel the excitement. It reminded me of the early days of microcomputers. Moreover, once I got past the clerks and secretaries, there were plenty of real hackers.

Mike Lehman, who originally wrote Pascal MT+ and was later a vice president of Digital Research, has started a new company called Maxisoft. The product is MaxiPlan, a combination spreadsheet and database with chart capability. MaxiPlan knows how to do a lot of statistical calculations. It will make databases and charts, and it will talk to you through the Amiga's speech synthesizer. You'll spend a while on the manual—this thing is powerful, and the instructions can be complicated—but it's worth the investment. Highly recommended.

TDI Software has Modula-2 compilers for both the Atari and Amiga machines. The Atari version is a new release that fixes some problems with the original. Both versions work and should make it simpler to transport programs from Atari to Amiga. Long-time readers know I'm a Modula-2 fan; this is a reasonable implementation, and TDI is working to make it better. The chief problem is the documentation: TDI needs to give more and better examples of just how to

write and compile simple programs. Pournelle's law of software documentation: You can't have too many examples. I wish TDI would learn it.

The Amiga is known for its graphics; one of the best graphics programs is Deluxe Paint by Electronic Arts. Alas, they use an obnoxious copy-protection scheme. That's its only real fault; otherwise, Deluxe Paint is glorious. There's just very little you can't do with it. You can color-cycle portions of your drawing, so that waterfalls have running water; zoom in for fine details; and suchlike. It's a lot of fun. EA also has various games, some interesting, some boring.

Mindscape is another company that has developed some interesting Amiga software. The Halley Project is a spaceflight game that's part arcade but largely strategic; it helps to know something about planetary astronomy.

Activision has a whole bunch of Amiga software, including Music Studio, which I haven't much got into but which looks wonderful, and a series of illustrated text adventure games, including Hacker, which some say is the most difficult adventure of that type ever written.

In other words, there's a great deal of Amiga software: business, games, educational, programming tools. That, however, wasn't the real hit.

What was really impressive was the Amiga Sidecar, a box that turns an Amiga into a 99 percent PC-compatible. Moreover, since the Amiga is a multi-tasking machine, they were able to run PC software as just one job. It was eerie to watch Flight Simulator running as if on a PC and still see the famous Amiga bouncing ball in the background and a word-processing program running in the foreground. The Sidecar has both 8088 and 8087 chips and is supposed to sell for significantly less than a thousand dollars. An Amiga plus Sidecar plus hard disk would be one of the most powerful combinations around, and I had no problem designating that the number one pick of Spring COMDEX.

PROBLEMS

One problem I've had with the Amiga is that while I kept hearing about all

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\$14.95), and it consists of interviews with a whole bunch of hackers, including Dan Bricklin (VisiCalc), Andy Herzfield (Macintosh OS), Bill Gates (Microsoft BASIC), Wayne Ratliff (Vulcan, which became dBASE II), and many others. Quite readable and provides good insight into the varieties of

hacker mentality.

I am now out of space, which is just as well because I'm also out of time: it's 2 a.m., and this has to be at BYTE by dawn. (I'll use BIX to send it.) Of course, it first must go through the spelling checker.

As I said, it's been quite a day.■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply.

amiga/softw.devlpmt #1920, from duck
a comment to message 1916

If you make heavy use of exec calls or graphics calls, you could preload A6 with the vector pointer and get rid of the interface library.

If the compiler itself knows the register calling sequence, maybe by use of the "prototyping" in new standard C, you could generate in-line code to call the library routines.

amiga/softw.devlpmt #1921, from jgoodnow
a comment to message 1919

If I preserve A6 in the library interface routines, then I might as well use it as the frame pointer. The problem is Aztec C calls Lattice C, which calls Aztec C glue routine. Even if the C functions save A6, so that Lattice C calling Aztec C works, there is still the problem with the glue routines. As pointed out, the problem exists with other languages as well.

amiga/softw.devlpmt #1922, from w.volkægis
a comment to message 1921

I'd opt for less TStates. . . .

BTW, does the IEEE support include an option for the 68881? I'm surprised at the number of calls we get on the subject.

amiga/softw.devlpmt #1928, from sdb [Scott Ballantyne]
a comment to message 1913

Jim, having A6 used as the frame pointer would incredibly ease ports from UNIX (PPC) compilers. (It is no fun wading through 3000+ lines of 68K code and dealing with register/frame differences.) In fact, as the compiler is currently set up, it may not be possible to do a port without a complete rewrite (having A4 as a register variable would ease that). I don't know how many others have problems like this, however. On the other hand, for original applications, the current solution seems the best (A5 = frame pointer).

Speaking for myself, and attempting to take advantage of your nice-guy nature, I would love to see yet another switch (yas, indeed) for this. I do think there is more at issue than simply porting code from Amiga C by Lattice and Manx back and forth, or using modules created by one compiler with another.

ATARI ST

Software seemed to be on the minds of most of the participants in the Atari ST conference this month. The first thread begins as a case of missing memory and evolves into trying to "fool" the GEM graphics mode. The second thread picks up the general topic of graphics, but from a rather different point of view, that of low-level bit manipulation. Accessing BIOS from interrupts, accessing the command line from Modula-2 and making your ST act like a VT52 round out the section.

MEMORY MAP

atari.st/tech #169, from sprung [Ron Sprunger]

I am trying to use TDI M2 from C-Shell, and some playing around has revealed interesting problems. Dave Beckemeyer sends the C-Shell in two versions, one of which doesn't support GEM programs. Since the TDI compiler and linker are GEM programs, I can't compile or link under that one, but it lets me have about 62K more transient programming area to work with.

The memory is important, because I need a minimum 600K RAM disk to carry all the standard library modules, plus compiler, linker, and

MicroEMACS. If I put the non-GEM C-Shell in AUTO and boot, MDISK tells me it can give me a 702K RAM disk, meaning 298K not available. MDISK is the Michifron RAM disk program. MDISK reserves 128K for TPA, and C-Shell program size is about 67K, leaving 105K unaccounted for, unless C-Shell reserves a bunch.

If I come up on the desktop, MDISK offers me 709K, which seems to be its maximum, even though the docs say 800K. Now GEM programs are supported, and if I go into the GEM C-Shell, MDISK offers only 640K, meaning that the GEM-supporting version of C-Shell seems to need an extra 62K for something.

The reason I mention the details is that if you make yourself too big a RAM disk, then run C-Shell, things seem to be OK, but you are prone to nasty crashes with no error messages.

Now for a (nearly) undocumented feature of C-Shell. The docs on the disk for the non-GEM C-Shell mention that it does not support the "gem" command. The "gem" command is mentioned nowhere else, either in the manual or in the disk docs. Before discovering this, I was running Modula and Linker from C-Shell by simply typing in the program name "modula," etc. I would then come into Modula with a slightly shrunken window and with or without a mouse (by some whim I could not discern). Entering a GEM program without the mouse can mean hangup time if you haven't a valid file on the logged disk, as you can't get to the CANCEL command without a mouse. Anyway, if you want to run a GEM program from C-Shell, type "gem progname" and you're in fine shape.

The MDISK program is not without fault—it requires an extra 15K for each RAM disk it sets up, and it insists on copying any .ACC files plus the desktop.inf file to the created RAM disk, where they haven't the slightest business being.

Can someone tell me where the 90K mentioned above is going?

atari.st/tech #288, from jerryb [Jeremy Brown]
a comment to message 169

Ron, MDISK copies the .ACC files because you should be using the MDISK in an AUTO folder, where it would copy the files and load them much quicker than from floppy. A better RAM disk is HippoRAMdisk (much better than I hear their C is/was). It allows use in an AUTO folder and accesses a text file where you have the RAM disk size plus a list of all the files you want to automatically copy into the RAM disk. There is a special function to create this file, and you can edit this file later if you wish. In the file copy list, wildcards are supported (as are folders). Whether you can use this special feature from outside an AUTO folder I do not know. I recommend that you look into it. I have also used MDISK and would rather go without. Note: The HippoRAMdisk I am referring to is a post-updated one from before TOS ROMs.

atari.st/tech #289, from sak [Sal Magnone]
a comment to message 288

Doesn't any program running in the AUTO folder boot into that blasted low-resolution mode? What a bug!

atari.st/tech #291, from swestrup [Stirling Westrup]
a comment to message 289

That's right, and I've never found a way around it! If anyone knows how to boot into an AUTO folder program in medium resolution, I want to know about it!

atari.st/tech #292, from [tittsler [Jim Tittsler, Atari Corp.]
a comment to message 291

The easiest way is to have a program in your AUTO folder ahead of the program you want in medium res that does nothing more than go into medium resolution and then terminate. Remember that programs will

(continued)

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be executed in the same order that low resolution will display them (in COMMAND.TOS). Starting with a new disk/AUTO folder, just copy the medium-res program into the folder first, then the desired program(s).

atari.st/tech #294, from jim_kent [Jim Kent]
a comment to message 292

I'm curious about this AUTO folder stuff. Does this mean that if I execute a little program that does a SetScreen((long)-1, (long)-1, 1) and then quits, GEM will be usable with the correct fonts, etc., for later applications programs? I guess the AUTO folder stuff is done before GEM is fully initialized, before the desktop.inf file is read maybe?

This sounds like something perhaps quite useful to many people who need to "trick" GEM a little. Please tell us more!

atari.st/tech #306, from swestrup
a comment to message 292

Unfortunately, it is *not* possible to create a program that does a set screen call that works from the folder. The reason is simple: The AUTO folder is executed immediately after boot-up. That means that the machine will be in low resolution when it encounters the set screen command. It will note the new resolution to itself and then reboot. While rebooting, it is still in low res and executes the AUTO folder. It makes a note reminding itself to go into medium res and then reboots. If you write a program that cheats by setting the video registers, then there is, as far as I have been able to determine, *no way* to tell GEM that you have changed its resolution and it keeps on using the old fonts, etc.

atari.st/tech #310, from wes.peters [Wes Peters]
a comment to message 306

Can't you just make your program switch to medium res and then switch back to low res on exit so GEM can do with it what it will? I have a monochrome system so I can't try this out, but can't you just switch modes and then jump through the reset vector stored somewhere in the "biblical" system variables?

atari.st/tech #311, from jim_kent
a comment to message 310

Sure, if you don't use GEM inside your program, you can switch it back and forth. I believe you'll have a small problem if there's an I/O error and GEM wants you to cancel/retry, though. Anyway, I switch modes all the time from TOS programs.

LINE-A ROUTINES

atari.st/tech #229, from chriskuku [Christoph Kukulies]

I am stuck in a problem due to lack of documentation of the \$1007 (bitblt) (read \$a007). It says in the Line-A document that A6 points to a block of parameters. Maybe someone can give me a layout on these parameter blocks. I wanted to switch the logical screen base with Setscreen(), then draw something hidden with VDI calls, and then perform a vro_cpyfm(...) with source_mfdb and dest_mfdb set (not equal to zero). vro_cpyfm does not work (!), so I turned, like so very often before, to Line-A. Who can help me?

atari.st/tech #232, from jim_kent
a comment to message 229

Chris, this is well documented if you have the developer's kit on pages 6 and 7 of the Line-A document. It looks something like:

```
struct blit_block
{
    short b_wd, b_ht;
```

(continued)

```

short plane_cd;
short fg_color, bg_color;
char op_tab[4];
short s_xmin, s_ymin;
short *s_form; /* pointer to the source pixels */
short s_nxwd, s_nxln, s_nxpl; /* offsets to next word, line, plane */
short d_xmin, d_ymin;
short *d_form;
short d_nxwd, d_nxln, d_nxpl;
short *p_addr; /* == NULL for no pattern */
short p_nxln, p_nxpl;
short p_msk;
char pad[24];
}

```

The `op_tab` is one of the more cryptic bits of raster logic I've seen. It works with the `fg_color` and `bg_color`. If you tell me more specifically what you want to do, maybe I can tell you the color/op combinations to try.

atari.st/tech #234, from alexl. [Alex Leavens]
a comment to message 229

Check over in the GEM conference for commented C source code on using the bit-bit routines from C. The parameter blocks are identical to what you need for the Line-A stuff. The files in question are in `gem/listings.st` and are `CRABSC` and `MULTBALL.C`.

atari.st/tech #296, from chriskuku

Now I'm at the point where I need to know more on the `op_tab[]` parameters. Where can I get this Line-A Document (which is obviously more detailed than where my information came from)?

atari.st/tech #299, from jim_kent
a comment to message 296

Try making the `op_tab = {4, 4, 7, 7}`, `fg_color = color`, `bg_color = anything`, and `s_nxpl = 0`. This will take a single plane source to the dest, making the dest color where there are ones in the source plane, and leaving the dest alone elsewhere.

However, the `opcolor` combination stuff is probably better described

in the GEM VDI manual (chapter 6) than in the Line-A bit.

I got what documentation I have from Atari. \$300 for the developer's kit... the dread Aicyon compiler, etc., and some documentation.

atari.st/tech #303, from chriskuku
a comment to message 299

Thank you, Jim, for the quick answer. However, I still require additional information on the meaning of the `op_tab`. It seems that the raster-op table in the GEM VDI manual does not correspond to the bit combinations I found. Could you or alexl. be so kind as to send me the necessary information to make bit-block transfers "by hand," that is, any source, any destination, any mode, preferably for monochrome but color wouldn't do any harm. Until I get the Line-A document from Atari you are my only hope.

Another point: What are the `xmins`, `ymins` for... clipping?

atari.st/tech #304, from jim_kent
a comment to message 303

Indeed, the `xmins`, `ymins` are for clipping. Not many things are clipped by it, though. Rectangular area fills are affected.

OK, OK, here's some more stuff on the `op_tab`:

`op_tab[0]`—logic employed when foreground and background colors for current plane are both 0.

`op_tab[1]`—when current plane `fg_color` bit is 0 and `bg` is 1.

`op_tab[2]`—when `fg` is 1 and `bg` 0.

`op_tab[3]`—when `fg` is 1 and `bg` is 1.

Now for the logic...

- 0 D' = 0
- 1 D' = S AND D
- 2 D' = S AND [NOT D]
- 3 D' = S
- 4 D' = [NOT S] AND D
- 5 D' = D
- 6 D' = S XOR D
- 7 D' = S OR D
- 8 D' = NOT [S OR D]
- 9 D' = NOT [S XOR D]

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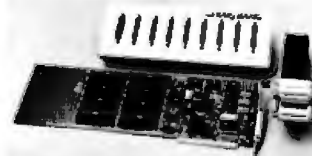
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10 D' = NOT D
 11 D' = S OR (NOT D)
 12 D' = NOT S
 13 D' = (NOT S) OR D
 14 D' = NOT (S and D)
 15 D' = 1

So this is the official stuff, but what does it mean? Another example: If you want the (new) destination to be a copy of the source, set
 op_tab[0] = op_tab[1] = op_tab[2] = op_tab[3] = 3 bg_color
 = fg_color = anything.

USING BIOS FROM INTERRUPTS

atari.st/tech #266, from rchecketts [Rick Checketts]

Has anyone tried calling the Atari ST BIOS from an interrupt routine? I was trying to use the serial I/O routines from within an interrupt, saving registers and using a private stack space, etc., and while the program ran for a while, it bombed for no apparent reason. Any ideas?

atari.st/tech #269, from dayjon [David Jones]
 a comment to message 266

I don't know if this is any help, but I was having similar problems—I was calling some of the sound-oriented BIOS calls in an interrupt routine and kept getting lots of bombs after a while of correct operation. I solved the problem by disabling all interrupts at the start of the routine and enabling them again afterwards. My best guess is that the BIOS re-entrancy rule (no more than 9 levels, I believe) is being violated or something.

atari.st/tech #271, from jim_kent
 a comment to message 269

No more than 3 levels of re-entrancy, I believe.

atari.st/tech #273, from sak
 a comment to message 271

Plus, aren't there 3 or 4 routines that cannot be called during system processing at all? I don't have the guide handy, but I do remember something about using the printer during a BIOS interrupt. (Excuse me, TRAP! Old habits die hard.)

atari.st/tech #278, from rchecketts
 a comment to message 273

The guide does say something about the printer but my routines didn't try talking to the printer. I did try blocking interrupts, and while this had some effect, it did not cure the problem. I did notice that the crash usually occurred during evtnt_multi, so I tried flagging that evtnt_multi was active and skipping the interrupt routine and again this helped; that is, the program ran a bit longer and then bombed. I've worked around it for now by leaving the interrupt just doing timing, etc., and leaving the rest to a fake interrupt that's just called as often as possible. Not an ideal solution. I'd still like to do it right!

atari.st/tech #279, from jittsler
 a comment to message 278

Here are some notes on using a BIOS function within an interrupt handler:

Nested Traps and Interrupts

Occasionally it may be necessary to make "nested" BIOS calls (for instance, to get keyboard input from a critical-error handler). The BIOS is re-entrant to three levels; the total number of standard and extended BIOS calls may not exceed three. Exceeding this limit will cause the

(continued)

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system to crash.

It is possible to call the BIOS from an interrupt routine. The basic problem is to get around a non-atomicity bug in the BIOS trap handler. Before the interrupt routine can call the BIOS, it must decrement the system variable "savptr" (\$4a2 long) by 46; after the trap, "savptr" must be restored to its original value. The interrupt code is responsible for its own mutual exclusion. This interrupt "level" does not count as one of the three nested BIOS calls.

Applications should not attempt disk or printer I/O from critical-error or interrupt handlers.

COMMAND LINE

atari.st/questions #205, from sprung

Can someone give me a quick rundown on the command line? I need to pick it up from Modula. Where is it and what's the format? It must be in these docs somewhere.

atari.st/questions #222, from alexl.
a comment to message 205

Ron, the command line is a simple little thing that sort of allows you to do MS-DOS-like things (like passing parameters to a program). Don't bother with it. Buy Beckemeyer's C-Shell.

atari.st/questions #223, from sprung
a comment to message 222

Thanks Alex—I know *what* the command line is. I need it for my own utilities in M2. I have C-Shell, and I talked with David Beckemeyer about the command line, but he didn't know how I could get it either. All I really need is a simple way to pick up the base page address at run time.

According to the review in May "Antic," Personal Pascal provides the command line, but no sign of it in M2.

atari.st/questions #224, from jtittsler
a comment to message 223

Well, I don't know how to do it from M2, but when a program is invoked, a pointer to the base page of that program is available under the long on the top of the stack. In code (which is a bit easier for me to deal with than English):

```
start: move. 4(a7),a0 * a0 now points to the base page
      move.l a0,___base * put the pointer in the C
                      * external
```

It is quite possible that the M2 run-time library does something similar.

atari.st/questions #225, from sprung
a comment to message 224

"under the long . . ."—What exactly is in A7? And what does the 4 do to that number? I can pick up the A7 register (or any other), but I'm not clear on how to make that into the base page address.

atari.st/questions #226, from cheath [Charlie Heath]
a comment to message 225

```
move.l      4(a7),___base
```

will take the address that was the last thing put on the stack into "___base," which you can reference within the language (assuming M2 has the same underscore convention as C).

atari.st/questions #227, from sak
a comment to message 226

Yeah, but isn't that assuming the M2 run-time library hasn't used the stack already?

atari.st/questions #228, from sprung
a comment to message 227

That seems to be the case—I've been playing around with it and have managed to pick up and reference the address off the stack, but it does not contain the base page address by the time I get it. Sigh. I'll have to pursue it with TDI. Thanks, guys.

atari.st/questions #229, from jtittsler
a comment to message 225

A7 is the stack pointer. It is a very reasonable thing for the run-time library to squirrel away that pointer before it does anything else. For example, in the developer's C compiler that I use, that function is the first thing done in the startup module (GEMS, GEMSTART, MYGEMS, etc.).

SCREEN ESCAPE CODES

atari.st/questions #236, from sprung

Can someone tell me where, in the DevPak or elsewhere, to find all the screen and cursor control sequences for the monochrome monitor? Or exactly what it emulates, as I have the VDT book by Stephens. If VT52, my book lacks cursor on and off (which I got from Steve Tether's code) and reverse video.

atari.st/questions #237, from alexl.
a comment to message 236

The screen codes are in the "Hitchhiker's Guide to the BIOS."

atari.st/questions #239, from jruley [Jonathan Ruley]
a comment to message 236

Get the abacus "internals" book—it has a pretty good rundown. The emulation is incomplete VT52.

atari.st/questions #243, from jtittsler
a comment to message 236

The screen escape codes are an (improper) superset of those in the VT52, with a few additions from the H/Z-19 (and a couple more that provide similar functions but are accessible in a 2-character sequence instead of 3). Specifically, for the ones you asked about:

```
ESC e  Enable cursor
ESC f  Disable cursor
ESC p  Enter reverse-video mode
ESC q  Exit reverse-video mode
```

Also, someone was asking about wrap/nowrap:

```
ESC v  Wrap at end of line
ESC w  Discard at end of line
```

One shortcut to erase home is

```
ESC e  Clear screen and home cursor (same as ESC h ESC j)
```

IBM PC AND COMPATIBLES

The majority of this month's IBM PC section is taken up with an involved exploration for the answer to a seemingly simple question. A query concerning a single interrupt provokes lengthy discussion culminating in the dissection of PRINT. In addition to being informative from a systems point of view, this example shows the real nature of on-line conferencing, which allows running discussion without constraints of time or location. This central discussion is bracketed by a short thread on interfacing an Apple color monitor with a PC compatible, and

A D D - I N S

cludes connectors and cable to hook it to the floppy disk drives.

Besides Matchpoint software, the package comes with UniForm-PC (version 2), which makes the computer read CP/M disks as if they were PC-DOS disks. Used with the Matchpoint board, it also lets you use Apple SoftCard and North Star CP/M disks on a PC.

MatchPoint-PC retails for \$195. Contact Micro Solutions Inc., 125 South Fourth St., DeKalb, IL 60115, (815) 756-3411.

Inquiry 574.

Memory Upgrade for Atari 520ST

EZRAM 520, a 512K-byte memory upgrade for Atari's 520ST, raises RAM to 1 megabyte. Terrific Peripherals says the kit is designed for simple installation. You make the 13 solder connections on a template, not on the motherboard. The kit comes with a high-speed digital signal cable, and the memory banks are fully decoupled with high-frequency ceramic capacitors.

The upgrade kit has a suggested retail price of \$199

and is covered by a 180-day warranty. Contact Terrific Peripherals, 17 St. Mary's Court, Brookline, MA 02146, (617) 232-2317. Inquiry 575.

Multuser Converter Adds Serial Ports

Control Electronics has a line of multuser boards compatible with Software Link's MultiLink and with UNIX-based systems. The MultiSerial-4 and MultiSerial-8 add multuser capabilities to IBM PC ATs

and compatibles through the use of fully wired 25-pin RS-232C asynchronous ports. Each serial port can support either a modem or a terminal. The ports are fully programmable for start bits, stop bits, parity bits, and data-transmission rate. You can address as many as 64 ports.

The MultiSerial-4 port board lists for \$259; MultiSerial-8 lists for \$359. Contact Control Electronics Inc., 37450 Enterprise Ct., Farmington Hills, MI 48018, (313) 553-3400.

Inquiry 576.

S O F T W A R E • P R O G R A M M I N G L A N G U A G E S A N D A I D S

AC/FORTRAN Compiler for the Atari 520ST and 1040ST

Absoft Corp. designed its ANSI FORTRAN 77 compiler with debugger to run mainframe programs downloaded to an Atari 520ST or 1040ST. AC/FORTRAN is a disk-based compiler, requiring 46K bytes of RAM, which enables you to develop large programs on a standard 256K-byte machine.

Native object code for the MC68000 is generated by AC/FORTRAN. Development tools support of overlays and virtual arrays and dynamic linking of programs at run time. Included are a full-screen source-level symbolic debugger, linker, library manager, single- and double-precision floating-point software, complex number support, and a C interface. According to Absoft, there is no limit on code or data size.

AC/FORTRAN is source-compatible with Microsoft's FORTRAN compiler for the Macintosh and AC/FORTRAN for the Amiga. The program is not copy-protected and

sells for \$199.95. For more information, contact Absoft Corp., 4268 North Woodward, Royal Oak, MI 48072, (313) 549-7111. Inquiry 577.

C Library Support Package

CTools Plus consists of over 200 functions supplied in source code that run on the Microsoft and Lattice 3.0 C compilers. A utility is included that formats the source code listings for printing.

The program supports the IBM Enhanced Graphics Adapter, and you can create applications using more than one display adapter and monitor at a time. Other features include screen handling, windows, interrupt service routines, DOS directory and file handling, memory management, and string functions.

You can write memory-resident routines by accessing DOS functions from within an interrupt service routine. A sample program is provided that dumps the

screen to a disk file.

To use C Tools Plus, you must have an IBM PC, XT, AT, or compatible with MS-DOS 2.0 or higher, and a Microsoft or Lattice 3.0 (or later) C compiler. C Tools Plus sells for \$175. For more information, contact Blaise Computing Inc., 2560 Ninth St., Suite 316, Berkeley, CA 94710, (415) 540-5441. Inquiry 578.

Program in C Using English Syntax

Programming in C is possible without knowing C, according to cLine. The language cEnglish uses English-like syntax and compiles your programs into Lattice C-compatible source code.

Programs in cEnglish run on IBM PCs with MS-DOS or PC-DOS 2.0 or higher and a hard disk. They also run on the AT&T 3B series running UNIX, the ITT XTRA, XL, and XP series running XENIX, and the DEC VAX series.

The cEnglish Data Base Interface Library's functions provide access to C-ISAM and compatibility with PC-NET and any other MS-NET

file-sharing system, the company reports. The price of cEnglish is \$795. Contact cLine Inc., 3550 Camino del Rio N, Suite 208, San Diego, CA 92108, (619) 281-5593, 281-5593.

Inquiry 579.

Pascal Cross Compiler

The CP-97 Pascal Cross Compiler for the 8097 16-bit microcontroller on a chip runs on IBM PCs and compatibles. The CP (Control Pascal) system includes a screen editor, cross compiler, interpreter, translator, terminal driver, and run-time support software.

Compiler output is in intermediate p-code, which is later translated into 8097 object code. The editor, compiler, and interpreter are integrated into a single menu-driven module.

The CP-97 system costs \$200. Contact Allen Systems, 2151 Fairfax Rd., Columbus, OH 43221, (614) 488-7122.

Inquiry 580.

(continued)

SOFTWARE • SCIENTIFIC AND ENGINEERING

TUTSIM Linked with FFT

FANSY is a program that analyzes the time response of a TUTSIM model on the IBM PC and compatibles. Developed at the University of Waterloo in Canada, FANSY stands for frequency analysis and synthesis.

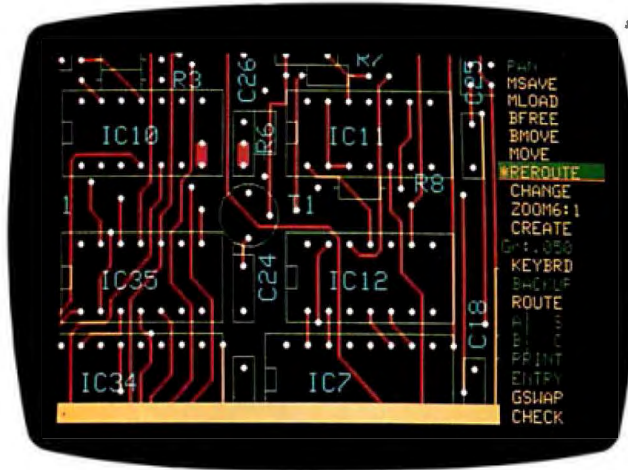
TUTSIM is a computer simulation program that uses block diagrams to implement system equations term by term. You can vary the model design, add or delete blocks, change interconnections, and vary parameters and values at any time during a simulation. Conversion of a filed time response of a TUTSIM simulation to the frequency domain is done by FFT routines.

FANSY requires the IBM Color Graphics Adapter to show gain and phase plots versus frequency. Two versions of FANSY come on one disk: Both run on the IBM PC, but one is for the PC with an 8087/80287 coprocessor. FANSY is priced at \$185. For more information, contact Applied i, 200 California Ave., Suite 214, Palo Alto, CA 94306, (415) 325-4800. **Inquiry 581.**

Data Acquisition and Display on the Apple IIe and IIc

You can perform numerical operations on large sets of data on an Apple IIe or IIc with Vidi-chart-IV. The program enables you to define four data sets of up to 8192 values, each with its own scaling information that transforms the raw data into physical values in any units you choose.

On a high-resolution screen (560 by 192 pixels),



EE Designer circuit design CAD package.

you can display up to four windows of any size at any position. Each plot is labeled with numbers and text labels along the axes, and you can superimpose additional labels anywhere on the screen. You can plot or overlay any data set in any window, using dotted or solid lines or filled-area plots in white on a black background. In any window you can shift, compress, or expand the x or y scale, or you can zoom in on a region framed by the cursors. The cursor displays any value along a curve.

You can enter data from the keyboard, disk, or joystick, and output data to the screen, disk, or printer. Menu list options, and on-line help screens are available for any commands. The program includes utility, numerical, normalization, baseline definition, and peak integration commands. You must have an Apple IIe with a 64K-byte extended 80-column card or an Apple IIc. The price is \$165. Contact Interactive Microwave Inc., P.O. Box 139, State College, PA 16804-0139, (814) 238-8294. **Inquiry 582.**

EE Designer Enhanced

Visionics announced enhancements to its EE Designer CAE/CAD software for circuit design and printed circuit board layout. It now supports the Enhanced Graphics Adapter in 640 by 350 resolution in 16 colors. And it supports the bus version of the Microsoft mouse and compatibles as well as the serial mouse.

The \$975 package runs on IBM PCs, XT's, AT's, and compatibles. Contact Visionics Corp., 1284 Geneva Dr., Sunnyvale, CA 94089, (800) 225-5669; in California, (408) 745-1551. **Inquiry 583.**

Three-Dimensional Graphics on the Atari ST

CAD-3D is a computer-aided design program for the Atari 520ST and 1040ST. It can create solid-model animation sequences and three-dimensional scenes in color, with shading from adjustable multilight sources.

The software uses Digital Research's GEM interface and comes with four sample scenes. It is priced at \$49.95. For more informa-

tion, contact Antic Publishing Inc., 524 Second St., San Francisco, CA 94107, (415) 957-0886.

Inquiry 584.

Mainframe Statistics Package on the AT&T UNIX PC

P-STAT has been converted from mainframe software to a package that runs on the AT&T UNIX PC (Model 7300). It manages and analyzes data by combining data and file management, data display, statistical analysis, survey analysis, and report-writing capabilities.

P-STAT features an on-line help facility, an interactive editor, flexible data entry and validation, relational database capabilities, macros, and statistical procedures. The program consists of a single source file of about 300,000 lines of FORTRAN code and costs \$995. For more information, contact P-STAT Inc., P.O. Box AH, Princeton, NJ 08542, (609) 924-9100. **Inquiry 585.**

Uni-CAD for MS-DOS Systems

Xysys announced that Uni-CAD, a computer-aided design program, is now available for IBM PC XT's, AT's, and compatibles. Uni-CAD supports systems with Color Graphics Adapters or Enhanced Graphics Adapters and one monitor, or it will run with two screens.

Uni-CAD requires PC-DOS or MS-DOS 2.1 or higher, 640K bytes of RAM, a graphics adapter, and a plotter. Prices start at \$1695. Contact Cyber/Source, 24000 Telegraph Rd., Southfield, MI 48034, (313) 353-8660. **Inquiry 586.**

(continued)

SOFTWARE • BUSINESS AND OTHER

Design and Paint with Atari ST

The GEM-based package PaintPro lets you design and paint on the Atari ST. It supports up to three active windows and comes with free-form sketching, lines, circles, ellipses, boxes, fill, copy, move, spray, zoom, undo, and text capabilities.

PaintPro works with most dot-matrix printers, the company reports, and it works with either monochrome or color systems.

The price of the program is \$49.95. For more information, contact Abacus Software, P.O. Box 7211, Grand Rapids, MI 49510, (616) 241-5510.

Inquiry 587.

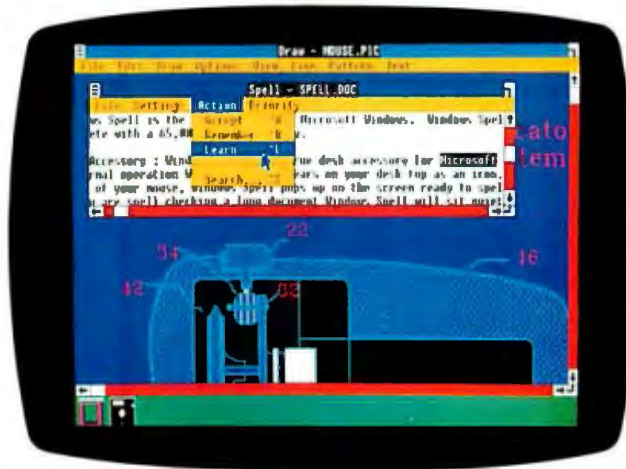
Amortization in C

MicroCost Software announced Effortless Interest, an amortization program written in C that runs on 64K-byte RAM CP/M-80 systems or IBM PCs and compatibles with PC-DOS or MS-DOS 2.0. The company reports that the program is accurate up to 14 significant digits.

With Effortless Interest, you select daily, weekly, bi-weekly, monthly, quarterly, semiannual, or annual payments on a loan, or compounding interest on a loan. Up to 36 combinations of time periods are possible. You can also value a monthly payment as an annuity, on the assumption of monthly payments and compounding of discounts, for as many months as you select.

Effortless Interest costs \$25. For more information, contact MicroCost Software, 22015 Marine View Dr. S, Des Moines, WA 98198, (206) 878-2796.

Inquiry 588.



Palantir's window-oriented spelling checker.

Spell-Check Windows

Palantir Software's Windows Spell was created for use with Microsoft Windows, but it will work with most windows documents, the company reports.

Windows Spell can check spelling in long documents while you work on another application. It will flash when it spots a spelling error. The program comes with a 65,000-root-word dictionary, and it will display guesses to help you correct misspellings.

Suggested retail price of Windows Spell is \$79.95. It runs on IBM PCs and compatibles with 512K bytes of RAM. For more information, contact Palantir Software, 12777 Jones Rd., Suite 100, Houston, TX 77070, (713) 955-8880.

Inquiry 589.

Printer Command Control

The memory-resident program Key Print from Instant Data Processing Inc. lets you send commands to keypress. You can set the trigger keys and printer commands although the program has predefined files that you can use or reconfigure.

IDPI claims that the program supports all printers. It is compatible with the IBM PC family and requires MS-DOS or PC-DOS 2.0 or higher. The minimum memory requirement is 128K bytes of RAM.

Key Print sells for \$18. For more information, contact Instant Data Processing Inc., 411 East Commercial Way, La Habra, CA 90631, (213) 691-0216.

Inquiry 590.

Business Database for IBM PCs

TeleMagic! maintains your database of contacts, telling you who to call and when, and even dials the phone. You can produce labels, letters, order forms, invoices, packing slips, envelopes, phone lists, and customer names with one keystroke. A scripting feature enables telemarketers to run through a sales presentation, making changes as necessary according to the customer's response.

The list price of TeleMagic! is \$95. Contact Remote Control, P.O. Box 2861, Del Mar, CA 92014, (800) 992-9952; in California, (800) 992-5228.

Inquiry 591.

Small Business Accountant

PC Accountant enables you to keep track of your small-business income and expenses. It can print and address checks, balance your bank accounts, and track accounts payable and receivable. It can also provide reports on income and expenses. PC Accountant can handle up to 200 names and addresses, 200 accounts with balances, and 1500 transactions per month. Menus and windows guide you through the program.

You need an IBM PC or compatible with 128K bytes of RAM, MS-DOS or PC-DOS 2.1 or higher, a monochrome or color monitor, an 80-column printer, and one floppy disk drive.

The program costs \$39.95 plus \$5 shipping. Contact Business Applications Inc., 3211 Bonnybrook Dr. N, Lakeland, FL 33803, (813) 644-5026.

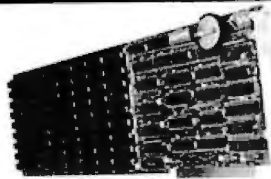
Inquiry 592.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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The LIMBO is only \$199 with 64K of RAM installed or \$549 with full 2 MB of RAM installed. The LIMBO II is only \$299 with 256K of RAM installed or \$499 with full 1.25 MB of RAM installed.

Go check out the LIMBO at the same store carrying other expanded memory boards. If they don't have the LIMBO, have them call us: 800/525-7674. Or write: Apparat, Inc., 6801 South Dayton, Englewood, Colorado 80112. 303/799-0819.



Apparat, Inc.

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with Lotus 1-2-3
Release 2

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- IEEE - Standard Floating Point Arithmetic
- IMPLICIT NONE
- Long variable names - 31 characters
- Fast Compile - Increase your productivity
- Source on Line Debugger (Advanced features without recompiling)
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a real saver. Could you just install a switch on the monitors to have them reverse at will? GEEZZ I love BIX!

Thanks to all you guys for your ideas and answers!

amiga/softw.devlpmt #2058, from jim_kent
a comment to message 2050

But the drawing of characters in a single line is so fast that I don't think it'd matter if it were backward anyway. Why not convert "this is a test" to "tset a si siht" and print it normally in your mirror font - providing you can't get the REVPATH to work.

amiga/softw.devlpmt #2065, from jdown
a comment to message 2057

Likely as not, a switch could be installed and work on a black and white TV. On a color, the convergence would certainly suffer. (In fact the convergence circuitry might make the yoke reversal more difficult as well. I was definitely thinking in terms of BW text for teleprompter applications. Am I wrong? If so the hack might take a couple hours of thinking, 20 minutes doing. And perhaps an hour or two reconverging the set. For that matter, doesn't Conrac make such monitors?)

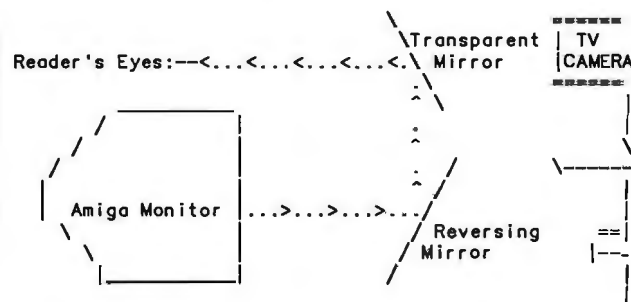
<^_>

amiga/softw.devlpmt #2066, from althoff
a comment to message 2058

I like that idea, Jim. Simple but effective!

amiga/softw.devlpmt #2127, from rsimonsen (Redmond Simonsen)
a comment to message 2047

Why not just use TWO mirrors to UNreverse the image? All you need is a front surface mirror for the lower mirror to keep the letters looking sharp for the transparent glass mirror. I would suggest an experiment with the Mylar mirrors made for shower rooms. They are cheap, bright, lightweight, and unbreakable.



ATARI ST

The Atari ST window for this month is devoted to software problems. To begin, one BIXen is writing a (fast) print spooler and sounds an open call for advice. Next, there is some concern when multiple copies of files begin appearing on various disks, and finally there is a discussion on structure name space standards for C, with an authoritative answer from a member of the ANSI standards committee.

WRITING A PRINT SPOOLER

atari.st/tech #421, from sgrimm (Steve Grimm)

I'm writing a print spooler for the ST (got sick of waiting for the printer). I'm using the 200-Hz system timer and a hook into the TRAP #1 vector. Anyway, I need to output a character to the parallel port during

the interrupt; obviously I can't use a Cprnout() call. Do I need to do anything more than store a 0x0F to the PSG Register Select (0xff8800) then put my data to the PSG Write Data at 0xff8802? Thanks in advance for any help.

atarl.st/tech #422, from json (Jez Son)
a comment to message 421

You are putting your own vector at TRAP #1, so you intercept all printed characters before the OS gets them. You are then buffering them and using the 200-Hz timer to (supposedly) output your buffered text on the interrupts to the printer.

When you put your vector into the TRAP #1 slot, you must have revectorized it back to the right place so that all other traps will work, right!?

So, whenever you wanna print something, all you do is emulate what the TRAP would do, by jumping to the *old* TRAP #1 vector address, with the stack appropriate setup so that when the routine does an RTE, it will return properly.

If you want any help with this, lemme know.

atarl.st/tech #423, from sgrimm
a comment to message 422

I had thought of that. I was just trying to speed things up a little by not bothering with an OS routine to do all my work for me.

atarl.st/tech #424, from davjon (David Jones)
a comment to message 423

I thought you weren't supposed to do OS-driven printer I/O from interrupt handlers. I remember seeing a message in this topic from jtittler on colling BIOS from interrupts. I would have thought that GEMDOS calls would be entirely out of the question, as it's not supposed to be re-entrant. I think directly outputting the chars (not forgetting the handshaking) would be best.

atarl.st/tech #425, from jsar
a comment to message 423

You are only running every 200 Hz. The Printer Output OS call can't be that slow, can it?

Poking the Sound-Chip's registers to get printer output sounds like going a bit far, when all you want is a simple way of printing characters. Also, what if the User has selected Serial Printer in their options table. What then? You going to do your own Serial Driver too?

I still maintain that using the legit OS way of printing characters by going through the vector that TRAP #1 would have gone through (assuming you altered it) is the best way.

There may be a problem of nesting GEM calls too far, but at the 200-Hz interrupt rate, I suspect this will never happen.

Beware of interrupt routines that do OS calls, though.

atarl.st/tech #426, from jsan
a comment to message 424

What about Serial Printers?

Who says anything about re-entrant code? That doesn't have much relevance, does it?

atarl.st/tech #427, from davjon
a comment to message 426

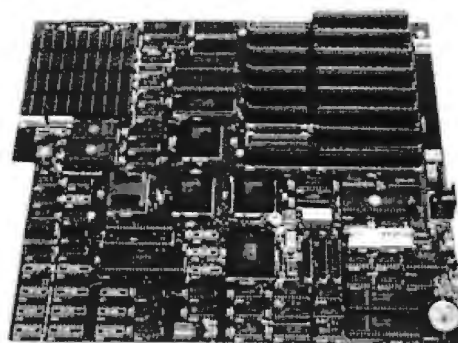
(continued)

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Well, suppose the interrupt occurred in the middle of a chunk of GEMDOS code, I would have thought that would cause a headache or two. I can't say I have tried using the printer from an interrupt, but I have tried using sound-chip BIOS routines - and they bombed out until I read the msg from jtittsler (#279 I think). Another problem you might have is if the buffering interrupt happened in the middle of a previous buffering call (say the printer's a bit slow). I can see that serial printers would be excluded, although you could directly poke the MFP chip. Isn't there meant to be a table of I/O driver vectors for LST and PRN devices? That would be easier to intercept than TRAP #1s.

atarl.st/tech #428, from jsan
a comment to message 427

Atari's HHG documentation does say that GEMDOS calls can be nested quite a few levels deep (6, I think). So I assume this to mean that if you're inside one GEMDOS call, and an interrupt occurs, you can at least use Printer Output.

If you can't, then I'm even LESS impressed with GEMDOS. How else do they want us to do it?

atarl.st/tech #429, from jim_kent (Jim Kent)
a comment to message 428

It's hard to write 6-deep re-entrant code. Usually it's 1 or 2, make a big effort to get it to 3, or when it's infinitely re-entrant it gets simple again - just shove everything on the stack.

atarl.st/tech #430, from davjon
a comment to message 428

P'raps you're right, Jez, but I thought that only BIOS calls could be nested - printer buffering is not something I have done (or intend to do). Every buffering source code I have seen has used desktop accessory code to do the job, which is crude, but I suppose it works.

atarl.st/tech #431, from jtittsler (Jim Tittsler)
a comment to message 421

You need to be VERY careful if you intend to mess about with the PSG since the operating system is using it periodically to check on disk changes. Changing the register select and the output must be done atomically. Test your data go somewhere you had not intended.

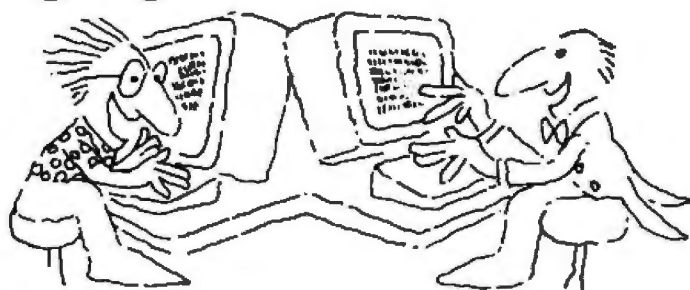
Unfortunately, the state of the register select latch cannot be preserved. Also, in the scheme as you have defined it, you must also toggle the strobe bit (and hopefully check the printer status bit).

GEMDOS FUNCTION \$07

atarl.st/tech #433, from dbetz (David Betz)

I wanted to upload my adventure writing system tonight, so I was trying to get rid of the last known bug. The adventure system displays a <<MORE>> prompt at the bottom of the screen when a single message contains more text than will fit on the screen with scrolling off. I implement this by printing the <<MORE>> prompt and then calling GEMDOS (or TOS) function #07 to wait for a character from the keyboard. I then return to

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the program that does the printing to dump out another screen full. The problem is that after the first call to function #07, all subsequent calls seem to return the same character without waiting for the user to hit a key. The result is that you get automatic paging for one page and then everything else scrolls off the screen. Has anyone else noticed this behavior? Is there a bug in function \$07 or am I doing something wrong?

atarl.st/tech #443, from sak (Sal Magnone)
a comment to message 433

I haven't tried it but that's the first I've heard of it. Have you tried calling GEMDOS(8) yet? It should be the same.

atarl.st/tech #452, from neilharris (Neil Harris, Atari Corp.)
a comment to message 433

Make sure you read all the characters from the buffer BEFORE attempting each GEMDOS #07 call.

CONSOLE INPUT PROBLEMS

atarl.st/c.language #107, from padams (Patrick Adams)

Using DRI C68, we have discovered that a carriage return does not serve as a new line for console reads. It is necessary to enter a ^J (linefeed) to terminate the input. The problem is with fgetc reading stdin. Is there another function we can call?

atarl.st/c.language #108, from jriley (John Riley)
a comment to message 107

Try rawcin (I cannot remember the function number - check your BIOS refs).

atarl.st/c.language #110, from chriskuku (Christoph Kukules)
a comment to message 107

The problem is known. It lies in fgetc or below. I'm working on the bug and hope to get it solved soon. I don't want to switch to another compiler just because of this bug.

atarl.st/c.language #111, from alexl. (Alex Leavens)
a comment to message 107

Cconrs works, although you'll have to be careful. It's documented WRONG in the BIOS manual.

THE CASE OF THE MULTIPLE FILES

atarl.st/tech #461, from dbetz

Help!!

I just discovered one reason I was having so much trouble getting single-character input to work on the ST. I had SIX COPIES of int.prg on my floppy! What causes the ST to allow multiple files with the same name on the same disk and in the same directory (root in this case)? This is a *serious* problem. Does anyone know what causes it?

atarl.st/tech #464, from wes.peters (Wes Peters)
a comment to message 461

It seems that sometimes, if you Fcreate a file that already exists, GEMDOS doesn't delete the old file; it just creates a new one with the same name. I use my own 'open' function, which checks to see if the file exists, and if so, Fopens it; if not, Fcreates it. A bit slower, but no more duplicate files. The routine is quite simple and is left as an exercise for the reader. (I've ALWAYS wanted to say/write that!)

atarl.st/tech #466, from mmallett (Mark Mallett)
a comment to message 464

It's OK to write a new open() routine, but I have gotten duplicate files produced by various purchased programs, as well as from desktop operations. I don't have any control over that.

atarl.st/tech #486, from sprung (Ron Sprunger)
a comment to message 473

Likewise here. I've gotten up to four copies of a file with the same name before noticing. It has happened from the desktop as well as from the C-Shell. It happens just seldom enough that my trust is built up, then it clobbers me - about every two weeks or so.

atarl.st/tech #494, from dbetz
a comment to message 464

That sounds like a "workaround" for a bug in the operating system. In my case, it is the linker that is creating the duplicate file, so I have no control over how it does so. I suppose I could get my shell script to delete the target file before running the linker, but what about people who use the GEM environment? They don't have a shell to program that way.

atarl.st/tech #495, from dbetz
a comment to message 473

Is anyone building a list of bugs in GEMDOS? I'd like to see it. It seems there are quite a few for a system that has been committed to ROM! Is the ST ROM structured like the one in the Macintosh so that it can be patched? The Mac vectors most routines through RAM so you can do patching. Does the ST?

atarl.st/tech #498, from batteriesinc (Mark Skapinker, Batteries Included)
a comment to message 495

I put up a list of bugs that I knew about, and yes, the ROM can be patched (as in the ROM patch from Atari for PLAYandRECORD). Well, Neil, how about compiling a list?

atarl.st/tech #499, from sgrimm
a comment to message 494

I've never gotten a duplicate file on any of my disks. Whenever one of my programs calls Fcreate, the old file is overwritten. Perhaps everyone has an older version of TOS?

atarl.st/tech #501, from dbetz
a comment to message 499

I am using a relatively recent 1040ST with TOS in ROM. I assume there is only one version of the ROMs, so I think I have the latest stuff.

atarl.st/tech #509, from sprung
a comment to message 501

Neil asked about version also, but I'm using TOS in ROM and assume, as you, that there is only one version - if not true, would appreciate the info.

NAME SPACE CONFLICTS IN C

atarl.st/main #173, from davep [David Pollak]

[Editor's note: Message #173 was a long one dealing with the relative merits of various compilers. We pick up the thread with a response to a specific part of that message.]

atarl.st/main #273, from wes.peters
a comment to message 173

I'm waiting for the Manx compiler or a good un*x clone with decent performance AND the capability of running (one) GEM application on the 'console.' By the way, the 'name space' conflict you're noticing with

structure offsets is a part of the definition of the C language. K&R mentions somewhere (in Ch. 7, I believe) a standard of making every structure-member name begin with a two-letter mnemonic for the structure name so name space conflicts will not occur. A holdover from their PDP-11 assembler, I guess. Remember, it's been documented, so it's not a bug, it's a feature!

atarl.st/main #274, from wes.peters

BLT: Was originally implemented on the PDP-7, I think. It was an instruction for transferring blocks of memory words from one location to the other. Also, a sandwich containing bacon, lettuce, and tomato. From the 'Jargon' file.

atarl.st/main #275, from cheath (Charlie Heath)
a comment to message 274

Re: 64K data areas. If you use offset addressing (like Aztec) you can address +/- 32K bytes.

atarl.st/main #293, from mmallett
a comment to message 273

You are quite right in saying that the "name space conflict" between different structures is upheld by K&R (page 197, to be exact). You have to keep in mind that while the K&R book is THE reference for the C language of its time, C has undergone a number of changes since 1978. At this point, any compiler that does not maintain separate name spaces for structure members has to be considered deficient.

Anybody know what the ANSI proposal has to say on this topic?

atarl.st/main #302, from jim_kent
a comment to message 293

ANSI says you get separate name spaces for separate structures. ANSI says void is cool. ANSI also says that:

```
extern puts(char c, FILE *f);
```

is not only compilable but will check your parameter passing for you.

Unfortunately, this last ANSI feature has yet to be implemented in any compiler I've found. The first two

are quite common. Megamax C, Lattice C, (and hopefully soon on the ST) Aztec C all give you separate name spaces for structures.

atarl.st/main #303, from al (Alastair Mayer, author of BIX's CoSy Software)
a comment to message 302

The only C compiler I've seen that *doesn't* give you separate name space for structures was on an old Berkeley UNIX release for PDP-11s. Caused a few headaches when porting some software to it.

atarl.st/main #305, from jim_kent
a comment to message 303

You haven't seen the Alcyon one?

atarl.st/main #310, from shersee (Steve Hersee, Lattice)
a comment to message 293

ANSI requires separate name spaces for almost everything. BTW, the ANSI committee voted the standard out for internal letter ballot. This is a major milestone since, once the letter ballot is passed, changes to the standard will take 2/3 vote, not majority. I will be commenting more about this meeting in c.language and lattice.

Steve Hersee
International Rep X3J11
IOS WG14 C standards convener

atarl.st/main #311, from shersee
a comment to message 303

The OS-9 C compiler also does not support unique structure member names.

atarl.st/main #312, from jimomura (Jim Omura)
a comment to message 311

The current 68K version does. The 6809 version doesn't.

atarl.st/main #313, from shersee
a comment to message 312

At the micro show in Japan two weeks ago, the documentation still listed this limitation.

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atarl.st/main #314, from Jimomuro
a comment to message 313

Peter Dibble, who has it, says the limitation isn't there anymore. :-)

atarl.st/main #315, from bmoore (James W. Moore Jr.)
a comment to message 314

The Microware V2.0 68K C compiler *does* support unique struct names. The 2.0 release also allows up to 256 character identifier names, has PCC-like type checking warnings and a bunch of other goodies. I'd not consider the Japanese market representative of the state of the art at Microware. It takes a month just to send the update to Japan. After that, the stuff has to be translated and configured for the different machines. OS-9 updates in Japan usually lag the US market by 4-6 months. The V2.0 C compiler was released in March 1986. [K. Kempf]

IBM PC AND COMPATIBLES

The IBM conversations chosen for inclusion this month have a common theme: the display. The first thread begins with BYTE Consulting Editor Jerry Pournelle attempting to de-blink his cursor. The second concerns a snow-plagued screen and the effects of writing directly to the display adapter. The last thread answers the question: How do I change the default color on my CGA display? Finally, an omission from an earlier Best of BIX is rectified.

TURN OFF THE BLINKING CURSOR

lbn.pc/pc.software #1177, from Jerry (Jerry Pournelle,
Consulting Editor, BYTE)

I don't get a chance to get here often, so I would appreciate a positive answer copied into tojerry/queries.

Does anyone know a clean and elegant assembly language way to turn off the blinking cursor on an IBM PC and make it a transparent blob for using in word-processing programs?

lbn.pc/pc.software #1178, from skluger (Sigl Kluger)
a comment to message 1177

The only way to unblink the cursor is by hardware modification. I have unblinked all the systems I use and it usually takes only 5 minutes. Somewhere on BIX I have written up exactly what to do - will have to find it. Also, it'll appear in MicroC some day. Oh, unfortunately, the only useful non-blinking cursor is an underline since there is no hardware to reverse the character beneath the cursor. That'll be another challenge, and one of these days I'll do it.

lbn.pc/pc.software #1179, from rschnapp (Russell L. Schnapp)
a comment to message 1177

To kill the cursor entirely, you have to position it on the nonexistent 26th line, using the BIOS video interrupt. The code should look something like

```
MOV DX,1901H
MOV AH,2
XOR BH,BH    ;Set the page number
INT 10H
```

If you want to leave the cursor on but kill the blinking, I'm pretty sure you'll have to cut a trace or two on the video board.

(continued)

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SOFTWARE • PROGRAMMING LANGUAGES AND AIDS

FORTH Compiler for the Atari ST

Palo Alto Shipping announced the Mach 2/ST FORTH-83 multitasking development system for GEM and non-GEM applications. The system has a text editor, Motorola assembler, symbolic debugger, and floating-point math capability.

The \$59.95 Mach 2/ST runs on the Atari 520ST and 1040ST with either a monochrome or color monitor. Other Mach 2 systems are available for the Macintosh and the Amiga. For more information, contact Palo Alto Shipping, P.O. Box 7430, Menlo Park, CA 94026, (415) 854-7994. Inquiry 583.

C Database Management System Toolkit

Jaybe Software has released Cdb, a C database management system toolkit for UNIX systems. The toolkit comes with 25 programs that you can use alone or with other UNIX tools for developing UNIX applications. Cdb is driven by a dictionary that you set up with descriptions of databases, indexes, and reports. You can then edit

and scan the databases, which are made up of variable-length records and allow unlimited fields per record, unlimited records per file, formula fields, and unlimited key fields, according to Jaybe. You can also split or connect databases, or you can run them through filters to create new databases. Cdb supports fixed or floating-point decimal, dollar amount, date, and alphanumeric field types. You can reorganize and restructure records with the index generator and maintain multiple indexes at once.

For security in a multiuser environment, Cdb also features record locking, password protection, and read-only restriction. The toolkit is priced at \$495. For more information, contact Jaybe Software, 2509 North Campbell, Suite 259, Tucson, AZ 85719, (602) 327-2299. Inquiry 584.

LISP Library and C Programming Environment

Clisp is a LISP library and a programming environment for C that runs on IBM PCs, XT's, and AT's. The program contains over 100 functions, including LISP

primitives, predicates, and conditionals, a context-sensitive database and stack, and an interpreter to which you can add your own functions. The price of \$189 includes source code. Contact Frederick J. Drasch Computer Software, RFD 1, Box 202, Ashford, CT 06278, (203) 429-3817. Inquiry 585.

dBASE III Plus Compiler

WordTech Systems announced Quicksilver, a dBASE III Plus compiler that features assembly code output, networking, and windowing. You can define your own functions, and you have the ability to link compiled C routines into dBASE applications. The company reports that you also have access to dBASE Tools for C and up to 4000 memory variables.

A set of dBASE-like windowing commands, dB FRAME, is incorporated in Quicksilver. The commands enable you to use source code instructions to create up to 99 active on-screen windows. Quicksilver runs on IBM PCs, AT's, XT's, and compatibles with 256K bytes of RAM and MS-DOS or PC-DOS 2.1 or higher.

The basic Quicksilver package costs \$599 and includes the compiler, linker, PC-DOS libraries, debugger, and assembly code translator. MS-DOS libraries are available for \$79.

For more information, contact WordTech Systems, P.O. Box 1747, Orinda, CA 94563, (415) 254-0900. Inquiry 587.

Generate Screens in Any Language

Softway, publisher of the screen generator High Screen, reports that you can design screens in almost any language. When designing with High Screen, you can open windows, display and manage pull-down menus, and manage an on-line help facility. Cursor positioning and management, as well as tests and message displays, are performed by the resident module.

High Screen sells for \$199 and runs on IBM PCs, XT's, AT's, and compatibles with PC-DOS or MS-DOS 2.0 or higher. A minimum of 256K bytes of RAM is required. Contact Softway Inc., 500 Sutter St., Suite 222, San Francisco, CA 94102, (415) 397-4666. Inquiry 586.

SOFTWARE • SCIENTIFIC AND ENGINEERING

Scientific Word Processing

ChiWriter, a scientific word processor from Horstmann Software Design, runs on IBM PCs and compatibles with a minimum of 256K bytes of RAM and a Color Graphics Adapter. The word processor features cut-and-paste, search-and-replace, margin justification, and pagination. The company reports that it can han-

dle up to 20 fonts, which you switch by pressing function keys, and you can use an unlimited number of superscripts and subscripts.

The program is not copy-protected and costs \$79.95. For more information, contact Horstmann Software Design, P.O. Box 4544, Ann Arbor, MI 48106, (313) 663-4049. Inquiry 588.

Schematic Drawings Output to Plotter or Dot-Matrix Printer

HiWIRE is a menu-driven schematic design package that has a library of over 700 common components. Using a mouse, you choose the components, and they are then connected with wires and buses. You can modify the symbols and also create new ones with labels, lines, and arcs. You can output hard-copy sche-

matics to either a plotter or a dot-matrix printer.

To use HiWIRE, you need an IBM PC or compatible with at least 320K bytes of RAM and a Color Graphics Adapter or Enhanced Graphics Adapter. The program sells for \$895. For more information, contact Wintek Corp., 1801 South St., Lafayette, IN 47904-2993, (317) 742-8428. Inquiry 589.

(continued)

CHAOS MANOR

dresses, and generally make your life run better.

In *The Mote in God's Eye*, Larry Niven and I postulated a society in which nearly everyone carried a "pocket computer" that served as both notebook and entry to a universal memory bank. It looks as if that's going to come much faster than I thought.

I can't really help you choose between the Model 100, the Model 200, and the NEC PC-8201. I do think that once you've got one, you'll wonder how you lived without it.

ATARI ST

There still isn't enough software, and in particular there is no acceptable text editor for it, but in my subjective opinion, the Atari ST is still the most exciting machine of the year.

Whenever I say that I get flak from the MacTribesmen, who descend with fire and sword. "You early on trashed the Mac because there wasn't enough software. Now you're praising the Atari before the good software comes out."

There's some justice in that. The Atari, for all its merits, has yet to come out with a text editor as good as MacWrite. I keep hearing rumors of WordPerfect, but whenever I inquire, it's always Real Soon Now.

There'd be more justice in the MacTribesmen's views if Apple had sold the early Macintosh for a reasonable price. Instead, you got to pay two grand for the 128K-byte Mac just so that you could send Apple \$995 for the upgrade kit, and you still didn't have color or a large-enough screen. Of course I didn't recommend the early Macintosh.

Nowadays Apple is market-driven rather than guru-driven, and it's a different story. The new Mac Plus is a good machine. On the other hand, I just don't see what the Mac can do that the Atari ST can't be made to do.

Certainly the Atari hasn't caught up with the Mac yet. There is some good software for the Atari, but not enough. Still, some, as we'll see in a moment, is so good that you might want to go buy an Atari ST just for those programs.

Atari continues to improve the ma-

(continued)

THE ATARI TEN COMMANDMENTS

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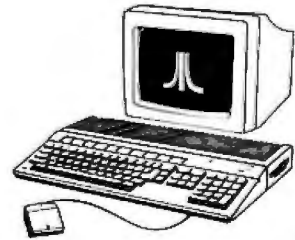
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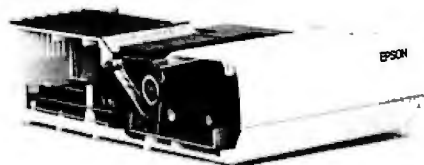
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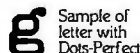
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CHAOS MANOR

chine, and I'm told that not long after you read this they'll have upgrades like a blitter (a hardware gizmo that makes graphics software faster and easier to write) and a math chip to speed up floating-point calculations; but there is still a crying need for some pretty basic software, particularly a good text editor.

There is also some pretty bad software out there.

ANTIC SOFTWARE

Antic is a software distributor run by people who like computers. In particular, they like the Atari ST, and they're publishing some great programs for it.

They also have some dogs, but I don't want to discourage you from dealing with them. Just be selective. This is a company that sells stuff so good you might want to get an Atari ST just to have something to run it on.

Let's get the deadwood out of the way first. Some of their "entertainment" software, such as Mom and Me and Murray and Me, is so corny I think I'd throw my Atari away if I knew I had to run them. These are computer "biotoons," described as "artificial personalities—sort of like artificial intelligence with a sense of humor." What they really are is a ghastly joke, and to add insult to injury they're copy-protected. Actually, I guess that part is just as well. Antic has some other games and gubbage I wouldn't recommend.

That's the deadwood. Now for the jewels.

Antic's CAD-3D is one of the best programs I've seen for the Atari or anything else. It's not a "real" CAD system, in that it doesn't have dimensions and some of the design features of professional CAD; but what it does have is the ability to do things in three dimensions.

With CAD-3D you can draw an object, then travel about as if you were riding a camera boom, so that you can look at the object from any angle. The object and light sources don't move; you do. Once you've seen all you want, you can then rotate the object itself. When that happens, the light and shadowing change.

To make drawing easy you can

define a shape, then “extrude” it to give it depth. You can spin objects to generate a solid of rotation. You can snap points to a grid, connect dots, and do many of the things one expects from a more expensive CAD program.

All this takes place on a small monochrome screen; but when you've got it all done the way you want, there's a "superview" command that generates the object, in color, for the full screen, so you can see it in all its glory. One of the items that comes with CAD-3D is Stonehenge (re-stored). Zoom in close or back off and see the whole thing. It's glorious by moonlight.

CAD-3D was written by Tom Hudson, the same programmer who did DEGAS for the Atari ST. That one is published by Batteries Included, and some of the artwork astonishes visitors here. When Hudson did CAD-3D, he included the ability to save a particular view/rotation of your CAD-3D object as a DEGAS file. You can then bring up DEGAS and call up your object to color it, add text, and do whatever you like to make a poster or a book page or whatever.

Between them, CAD-3D and DEGAS make the Atari ST worth owning.

Anticalso sells Flash, a communications program for the ST. I've only just got it running. It seems to be about as versatile as Crosstalk. I've been tempted to set the ST up in a place convenient to my desk and use it as a major machine just to get used to it. What stopped me was the need for a good text editor and a communications program. Now that I have Flash, I only need a text editor. More on Flash another time.

Interestingly, although Antic's ghastly joke programs are copy-protected, both CAD-3D and Flash urge you to make backup copies and put the original in a safe place.

AMIGA AND ATARI

If I seem a bit more enthusiastic for the Atari ST than for the Amiga, there are a couple of reasons. One is that for all its faults—like the stupid menus that drop down whether you want them or not whenever you get any-

(continued)

SUNDAY 10-5

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where *near* the top of the screen—the Atari's GEM operating system works. AmigaDOS is incomplete, and some of its details are a matter of folklore, not documentation. If you like to amaze your friends, the Amiga is the machine; but you may also find that AmigaDOS will drive you nuts.

Not that there isn't some folklore in using GEM. I've only recently found out how to install things into the GEM

desktop. At least one key move is nowhere documented. Grr.

The AmigaDOS defects aren't crucial for users. Most Amiga application programs don't require that you do anything with AmigaDOS. Which is just as well.

My main reason for being just a little shy with the Amiga has nothing to do with the machine or its software. It's a good system, and the software

defects can and will be remedied, if not by Commodore then by the user community—provided that the Amiga survives.

That seems less problematical as I write this than it did a **month** ago. Commodore has had its Saturday Night Massacre, but the layoffs seem to have stopped, and the bankers who control the company seem willing to lend them more. One good year of sales and the Amiga is safe. Commodore also announced **upcoming** improvements.

I wish them well. It's a good machine; and as I've said before, I like the notion that Commodore will drive Atari to improve hardware, while Atari will drive Commodore to lower the Amiga's price; and the whole micro community benefits.

LITTLE COMPUTER PEOPLE

Little Computer People is a—I guess you have to call it a game—that runs on either the Atari ST or the Amiga. I understand there are versions for the Commodore 64 and Apple II, but I'm also told they're less interesting.

When you run the program, you discover that deep inside your computer there's a house, sort of like a dollhouse. If you watch that for long, a little computer person will appear to inspect it. Then he gets his suitcase and dog and moves in. About that time he turns to the screen and says something. Unfortunately, it's unintelligible.

Whatever it is must be interesting. I say this because I visited BYTE headquarters in Peterborough last week, and they had a machine set up with a little computer person in it. Stuck to the machine **was** a note threatening death and destruction to anyone who disturbed the computer or turned it off. This wasn't kindness. The BYTE staff was starving the little computer person.

It seems you have to feed them; this is done from the keyboard. The BYTE staff hadn't fed Henry, their little computer person, in a week. At least they think they hadn't. As it happens, I know two editors who took pity on Henry and snuck in to give him some food and water.

(continued)

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Ken Sheldon, my long-suffering technical editor at BYTE, says Little Computer People is the equivalent of turning your computer into a Lava Lamp. I expect he's right.

REFLEX AND REFLEX WORKSHOP

Most small-business people I know just sort of muddle along. They know they're wasting money, and they ought to keep better records to show them how to save; but there's never time to set up a system because there's just too much else to do. If that's your trouble, help is at hand. Borland's Reflex and Reflex Workshop can probably solve your problem.

Reflex was the first "outside-developed" program published by Borland International. For the few who don't know, it's a database manager for IBM PCs and clones. Actually, it's more than that. Reflex will take data from other places, like Lotus 1-2-3, dBASE II and III, and PFS files; reorganize it;

and issue reports. The program is something like what you'd get if you crossed a spreadsheet with a good programmable relational database.

Like all Borland products, Reflex comes with a thick book that explains, in great detail, just how to use the program. It also makes suggestions for applications. The book is complete and darned near worth the price of the program.

The result is something so easy to use, and so bulletproof, that one major publisher, Jim Baen of Baen Books, uses Reflex for all his accounting: inventory, keeping track of author royalties, foreign rights, sales and returns—the whole panoply of the publishing business. He does the calculations with Lotus 1-2-3 and uses Reflex to generate specialized reports that can track author sales, performance of cover artists, and the like.

The interesting part is that although he's using only Reflex and a PC, and

has a very small administrative staff, he's selling as many books as many larger publishing houses. Moreover, the larger houses use big mainframe computers and employ dozens of people to foul up their records, and thus have unhappy authors, while Jim has one of the best reputations in the business.

I wish my other publishers would discover Reflex; and of course it's useful in other businesses. I can say, unequivocally, if you use a PC much at all, you should know about Reflex. Sooner or later you'll have an application.

If that weren't good enough, there's Reflex Workshop. Reflex does the job; Workshop shows you applications. The 400-page book that comes with Workshop has sections on creating accounting systems; inventory control; business expense reports; real estate management; production, operation, and quality control; and just a whole bunch of other stuff. Just reading this book can help a small business manager. The included disk contains Reflex templates for everything from schedule management to generating form letters. Between them, Reflex and Reflex Workshop may be the best bargain in software today. Highly recommended.

WINDING DOWN

I'm late with this, and probably over my space budget. The computer book of the month is Chris Devoney's *Using PC-DOS* (Que Corp., 1986). This is the best DOS book I know of. It covers everything and has lots of examples.

I should be home all next month, so maybe I can write some science fiction. Of course, General Graham is trying to involve me in setting up a graduate Space Academy, but maybe I can fob off most of that work on someone else. I probably won't, though. ■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply.

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68000 WARS: ROUND 3

BY BRUCE WEBSTER

The bout resumes again as Bruce looks at four flavors of Macintosh

It's late July as I sit and write this; later, in fact, than it should be. However, the minor distraction of having a new wife and five more kids has slowed me down a little. Did I mention that we're moving to a new house in a week or so? One with a few more bedrooms and (hallelujah!) a private office. That should boost my productivity a little.

In the meantime, I'm sitting here in the family room, surrounded by computers (all of which are turned on, of course) and hoping that the oft-voiced rumors about ionized radiation from CRTs are just that: rumors. What have I got here? Four flavors of Macintosh: the original Mac, a Mac Plus (on loan from Apple), a HyperDrive 2000 (on loan from General Computer), and a Prodigy 4 (on loan from Levco); two flavors of Atari ST: a 520 (from BYTE) and a 1040 (on loan from Atari); one Amiga (again, from BYTE); and one Compaq (my own). I also have an Apple IIe, but it's up on the university campus right now. Out of all the computers here, the Compaq is the only non-68000 machine and, incidentally, the one I'm using to write this column. That might somehow be significant—but I doubt it. It probably just means that I'm too comfortable with NewWord 3 (a WordStar clone) to change.

So what's on tap for this month? True to form, I ran benchmarks on the four Macs, giving some real comparisons. I've got a look at some development software for the Atari ST and the Amiga, including a nifty 68000 assembler. I've also been playing with a beta copy of the Turbo Pascal compiler for the Mac and will have a brief report on that.

THE MACINTOSH PLUS

Well, Apple finally convinced me to upgrade the Mac 512K to a Mac Plus, which I did with some trepidation. I had heard numerous warnings about software incompatibilities, and such turned out to be the case. Right off the bat, I had to call Personal Computer Peripherals Corporation, the folks who are still graciously lending me a MacBottom hard disk, to get new boot software. You see, the MacBottom used to turn itself on automatically by sensing the +5-volt line in the serial port when you turned your Mac on. Apple, of course, dropped this line from the new serial ports on the Mac Plus. The new start-up program arrived quickly from PCPC and worked wonderfully. Better yet, I found I could partition the MacBottom into volumes that

used the old Mac filing system and the new hierarchical filing system. So I now have one 10-megabyte HFS volume and several 1- to 2-megabyte MFS volumes.

Second, I discovered that some of the Mac software I

had purchased more than two years ago (when I bought my original Mac) no longer worked, or worked erratically, on the Mac Plus. This included Microsoft Word (version 1.00), Multiplan (also 1.00), Dollars and Sense, and a few others. Sarah Charf at Microsoft graciously sent me a review copy of Excel to replace my rather antiquated version of Multiplan, but I have yet to receive an upgrade to Word, which has really limited my use of the Mac for word processing. On the other hand, most of my more recently acquired software works just fine, and it's nice having the 1 megabyte of RAM and the 800K-byte disk drives (along with the MacBottom hard disk).

Am I glad I traded in for a Mac Plus? Well, yes. Overall performance seems to be much better, I like the extra RAM and disk space, and it's nice to have the most recent model. To quote Oliver Wendell Jones (from "Bloom County"): "Hackers, as a rule, do not handle obsolescence well." If I were to buy a Mac off the shelf today, I'd get a Mac Plus.

MACINTOSH UPGRADES

Two firms, General Computer Company and Levco, are competing head to head in turning that little beige toaster on your desk into a high-powered workstation. Both upgrades—the HD 2000 from GCC and the Prodigy 4 from Levco—were shown at the MacExpo in San Francisco last spring (where I reported on them). Now both units are close to shipping, and both firms have been kind enough to lend me beta units for evaluation.

General Computer Company is famous for having brought out the first (and for a long time the only) internal hard disk for the Macintosh, the HyperDrive. While reviews for the HyperDrive have been mixed (see Gregg Williams's review in the December 1985 BYTE), GCC has still been able to capture a large share of the hard disk market for the Mac. However, growing competition has induced GCC to look at enhancing its product line, and the result is the HD 2000.

(continued)

Bruce Webster, a consulting editor for BYTE, can be reached c/o BYTE, P.O. Box 1910, Orem, UT 84057, or on BIX as bwebster.

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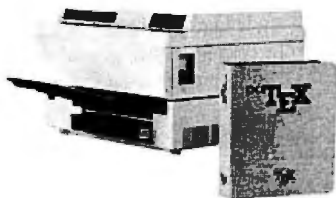
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ACCORDING TO WEBSTER

different programs were involved here: a floating-point benchmark, a Whetstone benchmark, and a Dhrystone benchmark. All were written in Mac (Consulair) C, and three versions were produced: a "generic" version for any Macintosh; a special version for the HD 2000 (labeled "HD special"); and a special version for the Prodigy 4 (labeled "P4 special"). The last two were produced using Mac C compilers specifically designed for each of the two machines. What's interesting is that the Prodigy 4 is (by deliberate design) able to run code specially produced for the HD 2000, but the reverse is not true. Furthermore, the Prodigy 4 runs the HD 2000 code two to three times faster than it runs on the HD 2000. As for the "VAX-on-your-desk" claim, note the Dhrystone benchmark for the Prodigy 4: 3201 Dhrystones/second. According to the source file for this benchmark, this exact same program runs at a clip of 1612 Dhrystones/second on a MicroVAX II and 2083 Dhrystones/second on a VAX-11/785. Not too shabby.

Would I recommend either one? In both cases, the issue is price/performance; that is, does the increased performance of the machine warrant the price? It probably doesn't for the HD 2000; even with the boost in floating-point calculations, there just isn't a sufficient increase in power to make it worth the price. The Prodigy 4 is simply out of the reach of most of us. On the other hand, for engineering and scientific firms looking to put high-powered workstations (like the MicroVAX) on individuals' desks, the Prodigy 4 can seem like a real bargain. Especially since the folks at Levco claim that they will be shipping UNIX for it by the time this sees print. Given a choice of one or the other, I'd choose the Prodigy 4—but I couldn't afford to put out the bucks for either one.

THE 1040ST

As I mentioned last month, an Atari 1040ST finally showed up at my front door, and I like it just as much as I thought I would. The 1 megabyte of RAM is great. TOS in ROM is great, the built-in disk drive and power supply are great. Given the development software that has shown up (discussed below) and the ST books from Abacus (discussed last month), I'm having a wonderful time writing code on the machine. I also got TOS in ROM for the 520ST, so now I've got two useful ST systems around the house. Right now, the 520ST is mostly occupied by my children, who spend vast amounts of time playing Time Bandit, Major Motion, and Mudpies, all games from MichTron Industries. (And I must confess that I've put in a few hours with Time Bandit and Major Motion myself.) Anyway, look for some Mac/ST/Amiga/IBM PC benchmarks in an upcoming column.

MEGAMAX C FOR THE ST

I finally—finally!—have a decent C development system for the Atari ST: Megamax C. Hippo C came and (mercifully) went; DR/Alcyon C was a pain to use and poorly documented; and I have yet to get my hands on a copy of Lat-tice C. Given Megamax C, I'm not sure if I really care to.

(continued)

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Megamax C comes with a suite of programs: editor, compiler, linker, disassembler, code optimizer, librarian, and shell. It also has the requisite header files and libraries so that you can make calls to GEM AES, GEM VDI, GEM-DOS, BIOS, and XBIOS. The shell puts you into a custom menu (drop-down) environment that lets you quickly go from editor to compiler to linker to finished program. It even has delete-file and rename-file functions, though I wish it also had a copy-file function. I just move all the important stuff onto a 440K-byte RAM disk (on the 1040ST, of course), and the whole system screams along.

The program editor is the nicest I've seen on the ST and comes the closest of any of those to emulating some of the Mac program editors (like Bill Duvall's EDIT). You can have multiple windows open, editing multiple files. You can use the "click-drag" mouse function to select blocks of text and transfer code between files. You can set tabs and toggle auto-indent mode (something of an obsession with me). You can even set an "auto-save" mode that will automatically save your program out to disk every few minutes.

The compiler is fast, as is the linker. Running off a RAM disk, I was able to compile a 500-line program—including two header files—in about 6 seconds; linking the same took another 12. With the "make" option (which allows you to edit your own link-and-compile file, then just run that from the main menu), the time is even quicker. If errors occur during compilation, the shell is smart enough to put you back into the editor and open two windows: one for your source code file, and one for the errors listing. It makes debugging a lot quicker than it would be otherwise.

I'll save most of the benchmarks for a future column, when I can get a full suite up and running. But just for idle comparison with table 1, I got 3.9 seconds for sieve; 6.0 for matrix; 4.4 for sort; and 3406 floating-point operations/second. And that was not using register variables.

PRODUCT OF THE MONTH: HiSOFT DEVPACST

I wasn't planning on having an assembler be the product of the month again, but that was before version 1.22 of HiSoft DevpacST showed up, along with a prerelease (version 0.16) of the Amiga version, DevpacAM. DevpacST is a complete 68000 assembly language development package, with an integrated editor/assembler, a debugger, a linker, the necessary include files, and a few sample programs. The 150-page manual comes in a small two-ring binder that lies flat; the manual itself is well written and well organized. And, as a welcome bonus, you get the *Motorola 68000 Programming Pocket Reference Guide*, a compact 120-page booklet listing all the 68000 instructions. The disk is not copy-protected, but then, not much development software is (thank heavens). The whole package costs only \$79.95.

Getting into the editor/assembler (GenST) is easy: Just double-click on the icon, and you're ready to go. You can now start typing in your program or load in an existing file. The editor itself is fast and fairly easy to use. It ac-

(continued)

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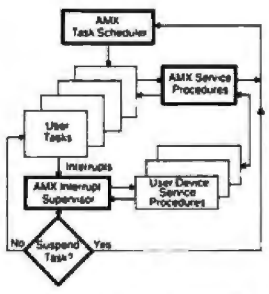
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cepts a subset of WordStar commands for cursor movement, as well as using the mouse and scroll bars. There are find and replace commands, a print-block command, and options to set tab length and toggle an auto-indent mode. It isn't a tremendously powerful or flexible editor, but it gets the job done nicely, and almost all commands can be done from the keyboard for those who don't like mice. I do have one major complaint, though. I can find no way of copying a block of text from one file to another. It is true that you can mark a block of text within a file, then move it, delete it, or save it to disk. But once you load in a different file, that block is "forgotten," and there is no mechanism for pulling text off the disk into the file you're currently editing. I hope that's fixed in future versions, because it's a real limitation.

The assembler is invoked from within the editor. It brings up a dialog box that lets you name an output file (if desired) and also indicate a listing destination (none, screen, printer, disk file). The assembler is quick and runs in two passes, the optional listing being generated during the second pass. You can pause the assembly by holding down the Alt key or abort it with the Esc key. Errors are listed as they are encountered. Once the assembly is done, any keystroke takes you back to the editor. If there were errors, you can then use the "Jump to Error" command to go to the errors in succession.

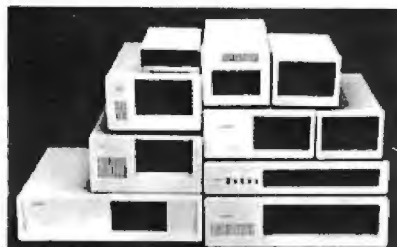
The assembler is full-featured, supporting the 68000 instruction set, complex expressions, a number of options (debugging information, macro expansion, case sensitivity, etc.), include files, alignment operators, printer commands, conditional assembly, macros with up to 10 parameters and with unique label generation, and so on. Labels can be just about any workable length; the first 16 characters are significant. You can choose to produce ready-to-run code or linkable code modules. In short, it has almost everything you'd want in an assembler.

Once you've produced working code, you need to exit GenST to run your program. What, then, if you have problems? Well, you can invoke MonST, the debugger that comes with DevpacST. When you run it, it brings up four displays on the screen: registers, memory, disassembled listings, and a command line. You can now set breakpoints, modify memory, single-step through your code, "interpret" an instruction (for example, make a trap call without having to single-step through the entire trap handler), disassemble areas of memory, and so on. If you included the D+ option in your source code, MonST pulls up the symbol table and uses your labels in the disassembly. The debugger is not as slick as Metascope (see below), but it still gets the job done. It uses a different location in RAM for its screen display, so it doesn't interfere with what your program writes to the screen (and vice versa). MonST actually comes in four flavors: GEM or TOS, and resident or user-invoked. All four versions are on the disk; you can choose the one that best suits your needs.

The linker (LinkST) supports the GST linker file format, but not the DR (TOS) format. The folks at HiSoft give three reasons for this: first, the DR spec wasn't made available;

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second, it appears (to them) that the DR format is "very restrictive"; third, (according to them) support from third parties is greater for the GST format. I don't know how valid those arguments are, nor how much of a limitation the lack of DR format support is. Also, the assembler lets you create only one module per binary file (though that module can have multiple XREFs and XDEFs), so you can't really build libraries with the assembler. Reference is made to using a "library creation program" to do the trick, but no such program is included with this version of DevpacST. On the other hand, I haven't had much occasion to use the linker, so I'm not really concerned.

By the way, the Amiga prerelease worked nicely. It had only the editor/assembler (GenAM), but that was enough for me to do a fair amount of coding, modifying a sample program that came with it (see below). I suspect it will be shipping by the time you read this; if so, consider it strongly for your Amiga assembly language programming needs.

DevpacST is a well-designed, well-implemented package with good documentation and an excellent price. It has done more to get me playing around with the ST than any other language or development system I've used to date, and the Amiga version threatens to do the same. As further proof of its utility, at least one commercial package for the ST—the arcade game Star Glider, written by Jez San and published by Rainbird Software—was developed entirely using DevpacST. HiSoft, and especially Andy Penell, should be congratulated for a job well done.

METASCOPE

The Amiga version of Devpac came with a sample program that brought up a small window and displayed (in hexadecimal notation) the amount of free memory, updating it whenever the value would change. The source code had the comment, "Conversion to decimal is left as an exercise to the reader!" Fine, I thought, and I exercised myself, scouring a collection of 68000 texts for a binary-to-decimal routine. Unfortunately, most handled only 16-bit values, since the DIVU instruction on the 68000 is a 16-bit instruction, and I needed to be able to convert 24-bit values. However, the text *Programming the Macintosh in Assembly Language* (by James W. Coffron, Sybex, \$24.95) had a nice routine that handled 32-bit values by using a table of divisors. I keyed it in, adapting it as I went and dropping the sections that dealt with negative numbers. Unfortunately, the new, improved program (called Free-Mem) insisted on dropping the last decimal digit: Instead of printing "181253 bytes free," it would print "18125 bytes free." And so I went to the bookshelf and dug out a hitherto unused copy of Metascope, a window-based debugger for the Amiga.

What a nice product. A quick scan through the manual—most notably Chapter 5, "Usage"—showed me how to set things up. When I ran Metascope, a status window appeared, showing me the contents of the 68000's registers (16 of them, plus the status flags). A few quick pull-down menu commands brought up a second window showing

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a disassembled listing of FreeMem. I scrolled through until I found the binary-to-decimal routine (called BinToDec), clicked on the memory location of its first instruction, and used the Once command, which ran FreeMem until it hit that location. At that point, register A0 had the address of the string FreeMem was going to print in its own little window, so I clicked on the contents of A0 in the status window and used a menu command to create a memory window, displaying the memory at the string's location.

I also created a memory window showing the divisor table used by BinToDec. I then was able to **single-step** execution through the program, watching the registers and memory locations change. The loop counter (in register D2) didn't seem to be synchronized with the divisor table, so I let FreeMem run until it hit the start of BinToDec again, then I started single-stepping again. When BinToDec loaded the address of the divisor table into register A1, I double-clicked on the contents of A1 in the status window, changed the value to start at the second table entry, then let the program run. Sure enough, it worked this time. Got out of Metascope, got into GenAM, edited FreeMem, assembled it, then ran it. Fixed!

Metascope does a lot more than I've explained here. Other window types (breakpoints, hunks, symbols) can be created. Logging to disk is supported. Various forms of single-step and continuous tracing are available. Lots and lots of menu options are available for the different window types, more than I care to describe here and possibly more than I'll ever use (unless I get really adventurous).

What can't Metascope do? Well, Chapter 6 (entitled "Limitations") points out that Metascope can't debug any tasks or processes that your program might start; that it can't be used with programs that take over trap handling; that single-stepping through time-critical portions of code where your program must respond to the system or has seized control of certain resources can cause crashes; single-stepping through certain system routines can also cause crashes; and so on. In short, the Amiga system is a complex multitasking environment, and Metascope can't handle all possible situations in it. I'm not sure, though, if any debugger on the Amiga will be able to handle those problems. As far as I can tell, Metascope is the best debugger for the Amiga. It's easy to use, very flexible, and works well.

TxEd

Up until recently, most of my program editing on the Amiga has been done with the Lattice Screen Editor (LSE), with occasional use of ED or EDIT, the two system editors that come with the Amiga. Then Charlie Heath of Micro-Smiths Inc. sent me the latest version (1.3) of TxEd, and I've dropped the other three completely. TxEd is a fast, slick program editor that eases a lot of the pain of entering code on the Amiga. What's more, it's quite a bit smaller than LSE, using less disk space (or, for that matter, RAM).

Yes, get TxEd if you're editing almost anything on the Amiga. It has the usual functions, though it tends to use the right Amiga key (i.e., the red "A" key to the right of

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Bobs also has the advantage of automatically eliminating visual unpleasanties as Bobs do beam-avoidance to create clean changing imagery. Someone wondered why 1.2 icons flickered when multiple Bobs were moved simultaneously. Don't know why that would be, but I suspect it's not a Bob problem and also not a Workbench problem. Probably something else was happening. For an example of many Bobs moving at once, see the Molly demo program from Amiga (don't know if this is still generally available).

I'm running 1.2 right now, and I drag multiple icons without any perceptible flicker. In fact, it looks pretty good!
RJ >:-{)*

amiga/softw.devlpmt #2325, from Jim_kent (Jim Kent)
a comment to message 2323

Hey RJ, you wouldn't happen to have any old VSprite stuff lying around? From what I hear the y sorting stuff and re-using all works OK, and that's the hard part. Is the problem just getting them to work with Intuition's slidable screens?

Also I've been wondering how Intuition has a solid background behind the last screen. When I was doing my own viewport/view manipulations, I always got garbage on the part of the screen not covered by a viewport.

amiga/softw.devlpmt #2326, from cheath
a comment to message 2323

Bobs do beam avoidance? That's news to me - the only way I've been able to keep Bobs from flickering is with double-buffered screen. One of the not-nice things about the bitmap architecture with blitter is that each bitplane is drawn before the next is started - so you often have a situation in which the display is updated while a large part of the screen is in transition. That sort of stuff doesn't happen without blitter so much, because the software can be written to do all the bitplanes in sync - so there is only a small part of the display that can look nasty at any given time.

ATARI ST

The Atari ST section begins with hard disk problems and a case of the seemingly simple disk crash and goes on to a thread on using Malloc() in C.

HARD DISK PROBLEMS

atari.st/tech #592, from chriskuku (Christoph Kukulies)

Today it happened...

My hard disk (Atari grey box) suddenly showed 0 bytes in 0 items. It was heavy-loaded with lot of stuff, about 40 directories with about 1500 files or so, all in all, 15 Mb of the 20 available. Does anyone know how this could have happened (other than typing rm *)? Before I start to reformat it - does anybody have a utility to look at the hard disk blocks to eventually repair it? Help welcome.

atari.st/tech #593, from Jim_kent
a comment to message 592

If it's 0 bytes in 0 items it's just as likely that the driver has gotten lost. Have you tried re-installing the driver and changing resolution from Preferences? I hope that's it. I don't know of any utilities that look at the disk sectors directly.

atari.st/tech #600, from alexl. (Alex Leavens)
a comment to message 592

Bomp! Bomp! Bomp!

Another one bites the dust! :-)

Sorry, just couldn't help it. Same thing happened to me Saturday. It's reformat time (your FATs have gotten roached). Next time you format it, partition it into four 5-Mb logical drives--this locates the FATs in different places, and makes roaching of the entire disk much less likely. Then you can use say drive F to back up drive C.

Good luck.

atari.st/tech #605, from chriskuku
a comment to message 600

Yes, I reformatted it already. Using Dust from Hippo, which allows you to look at disk blocks (sectors), showed me that some important sector was zeroed. By the way, this Disk Utility didn't work quite correctly because it said: "Not enough memory for FAT." So I gave up and reformatted it.

But, tell me, how can I partition the disk into different drives? Do I have to have a special program for this?

atari.st/tech #610, from nellharris (Neil Harris, Atari Corp.)
a comment to message 605

If your hard disk driver floppy did _not_ have the new format program which uses GEM and also partitions your drive, then your problem is that you're using old software for the driver -- contact Atari and get the latest disk right away!!!

atari.st/tech #629, from jtlittler (Jim Tittler, Atari Corp.)
a comment to message 605

You can partition it yourself if you like Chris using the information in the Hitchhiker's Guide and your favorite sector editor (or FORTH). The zeroth sector contains the partition map with pointers to (up to) 4 partitions. Each of the partitions has a "boot sector" which contains the normal disk prototype BPB.

MALLOC

atari.st/c.language #179, from chriskuku

I downloaded Tim's mallocer because I had problems with Malloc (gemlib). Now, although the mallocer works, my program still doesn't. I've #defined malloc __malloc and have written a function:

```
char *
__malloc(arg)
int arg;
{
    return( (char*)(Malloc((long)arg)));
}
```

to stay compatible with source code in respect to standard calls. I have a 1-meg machine, TOS (US) in ROM. My program is linked with gemstart.o gemlib aesbind vdbind libf, etc. After appl_init(), open_vwk(), I do some malloc()'s to allocate some nodes (only 200 bytes or so, application stuff). Asking available=malloc(-1L) tells me I have enough (xxxxx) memory. To verify this, I did just for testing a:

```
while(malloc(sizeof (struct node))nnodes++;
```

Totally in contradiction to what is expected by calculating from the value of available I now only get poor 132 or so nodes allocated (sizeof node is 18, but is not relevant).

Please don't tell me "use the L*T***E compiler. When such things can't be done with the dev-pack then

(continued)

Atari should please explain why they called it "developer's package?"

Do you have any idea? Comments would be welcome.

atari.st/c.language #180, from sgrimm (Steve Grimm)
a comment to message 179

I always had trouble mallocing in a routine that uses local variables. Try removing the parameter (set a global variable and have your malloc look at that variable).

atari.st/c.language #181, from chriskuku
a comment to message 180

Thanks. Your tip sounded promissing, but looking at my program, I saw that I've already done so. I call malloc(size) with size globally declared.

atari.st/c.language #184, from jim_kent
a comment to message 181

Chris - I've uploaded some memory management stuff into atari.st/listings. You probably would be best off getting Malloc to work somehow, but this might be a useful kludge to keep you going in the meantime.

atari.st/c.language #185, from chriskuku

Jim, thanks for your example listing. I'll try it as a last escape. Meanwhile, I've cut down the problem to a short example:

```
/* tstmallo.c CPK 4-JUL-86
 * this simple example shows my usage of Malloc
 * and it's mal(loc)function (if I haven't overlooked
 something).
```

```
*/
#include "asbind.h"
/* define some node stuff */
```

```
struct node {
    int x,y,z,pen;
    struct node *next;
};
```

```
struct node *first,*last;
```

```
main()
```

```
{
    int nnodes = 0;
    struct node *lastbutone;
    first = (struct node *) Malloc( (long)sizeof (struct
node));
    while( (last = (struct node *) Malloc((long)sizeof
(struct node))) ) {
        lastbutone = last;
        nnodes++;
    }

    printf("\n%d Nodes of size %d\nStart address
%08X\nLast address %08X",
        nnodes,sizeof(struct
node),first,lastbutone);
}
```

Maybe you can try it on your machine. I always get only about 100 nodes allocated and then finito.
Any help welcome.

atari.st/c.language #186, from jim_kent
a comment to message 185

Chris - I just tried your code. I'm working with Megamax, a 520ST with a 1-meg upgrade and TOS in ROM, and a hard disk.

With me, it got 268 nodes before it quit. Curious thing is that when I added a character array to the node structure to make it bigger it still got 268 nodes. It allocated 268 512-byte nodes OK! I've heard from various sources there are problems with Malloc. I'm not sure if I get more nodes than you 'cause I've got a meg, newer ROMs, or better luck. Still, it's very easy to allcate more than 268 times. Have you tried malloc with a little m? Yep, I'm sure glad I've got some proprietary (er, now public domain, I guess) memory management routines. I've had a lot of problems with various mallocs and Mallocs on this machine. Actually, the routine I uploaded has been simplified to allcate out of an array. What I really do in my "real" code is Malloc(10K), and then add the pointer to my free list with a mfree(pt, 10K) when the free list gets empty. Did I say 10K, I meant 32K, so it'll have some blocks big enough to hold a whole screen!

I've heard that the Megamax Malloc works in a

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similar way. I never got the Alcyon one to work properly. I forget if I got Lattice Malloc to work. I've never actually tried Megamax. It's kind of nice being able to peek at your own free list anyway for debugging, so since I got the sources, I use 'em.

atarl.st/c.language #187, from sgrim
a comment to message 185

According to the GEMDOS manual, one program isn't supposed to malloc more than about 20 times, or pointers start to get messed up. Try mallocing one big block and accessing it as an array:

```
#define NUMSTRUCTS 100      /* The number of structures
you want in your array */
```

```
struct node *nodearray;
```

```
alloc()
{
    nodearray = (struct node *)
Malloc((long)sizeof(node)*NUMSTRUCTS);
}
```

Hope that helps.

atarl.st/c.language #198, from timpanton (Timothy Pantan)
a comment to message 179

I don't know the answer to this one, I haven't played with Malloc for months (I wrote mallocer to test my 1-meg upgrade). However, looking at some code, I see I didn't trust casts in macros, i.e.,

```
Malloc((LONG) thing);
where thing is a word, I seem to have used
Malloc(lthing);
```

where lthing is a long, I'm not sure why; distrust of the preprocessor I guess.

My understanding of how Malloc() and malloc() differ is this:

TOS maintains a pool of memory. When a program starts up, it is allocated an amount of memory for code, data and stack. With GEMstart and GEMs this includes some extra to allow malloc to allocate from this area, and they include sbrk() which helps manage this allocation.

Appstart and acctest do not have this extra memory, nor do they include sbrk(), so malloc() can't be used. Malloc() is a TOS function which returns a pointer to free memory *outside* the programs area.

Thus, Mfree() really frees up memory for use by another program (say a print spooler accessory) whereas free() does not. free() in UNIX behaves the same way.

I haven't had any problems with malloc()ing too many times, but from the way TOS behaves in other areas (files, etc.) I can believe it.

IBM PC AND COMPATIBLES

The IBM section begins with questions on using ANSI.SYS for portability in a BASIC program. The end of this thread goes into a message from the BASIC conference for tips on calling assembly language routines and ROM BIOS functions from BASIC.

USING ANSI.SYS

lhm.pc/other #229, from jburtner (Jeffrey Burtner)

Where can I find additional information on the use of ANSI.SYS? I am trying powerful {looking} features of ANSI.SYS to manipulate the screen in BASICA. Also, I could use a recommended reference for the interrupt codes and DOS calls available.

lhm.pc/other #235, from feenberg (Daniel Feenberg)
a comment to message 229

Doesn't BASIC bypass MS-DOS for screen I/O and is not ANSI.SYS ignored by any BASIC program?

lhm.pc/other #236, from richard (Richard Shuford)
a comment to message 229

ANSI.SYS is documented in the DOS Technical Manual, which, since version 2.1, has been a separate volume (and purchase) from the DOS User's Manual.

I don't normally recommend the following periodical, but the November 1985 issue of "PC World" contains an article beginning on page 244 (excerpted from "The Fully Powered PC" by B. L. Alperson, A. Fluegelman, and L. J. Magid) that discusses the use of ANSI.SYS.

However, it may not do you any good, because I suspect that BASICA may bypass the normal console drivers for much of its work; therefore, you may not be able to do much with ANSI.SYS in conjunction with BASICA.
.....RSS

lhm.pc/other #237, from dmick (Dan Mick)
a comment to message 235

Not if you use OPEN to open a device and then write to it with PRINT#. I think the actual device changes from interpreter to compiler. In the interpreter I believe it's SCRIN: and in the compiler TRM: or CON: or mebbe CONS: I'm away from the machine that has the answer on its hard disk, but I know you can drive ANSI from both int. and comp. with the OPEN / PRINT# trick..

lhm.pc/other #241, from btonkin (Bruce Tonkin)
a comment to message 229

Why are you using ANSI.SYS stuff from BASIC in the first place? Given that you already have LOCATE, CSRRLIN, POS, COLOR, and SCREEN commands (not to mention graphics), it seems a little strange to me. Kinda like going back a few years to the days of dumb terminals.

lhm.pc/other #242, from jburtner
a comment to message 237

That's exactly what I'm trying to do. I open "ANSI.SYS" as #1, then try to send my console output through it using IOCTL #1, etc. But I'm still not having a lot of luck; I keep getting a function error on my IOCTL line. It's very easy from Turbo Pascal, but my application must be written in BASICA or GW-BASIC. How about a way to clear to end of line or clear to end of screen for use in BASICA?

lhm.pc/other #245, from richard
a comment to message 229

Perhaps if you are serious about complex applications, you should get the replacement, NANSI.SYS, from Hersey Microsystems.

Any implementation of the ANSI X3.64 standard is going to be a subset. I don't think that any real device could possibly use all the codes and be comprehensible. The full list of codes is there to provide a standard way of doing a certain group of functions. If your device doesn't do a given function,

(continued)

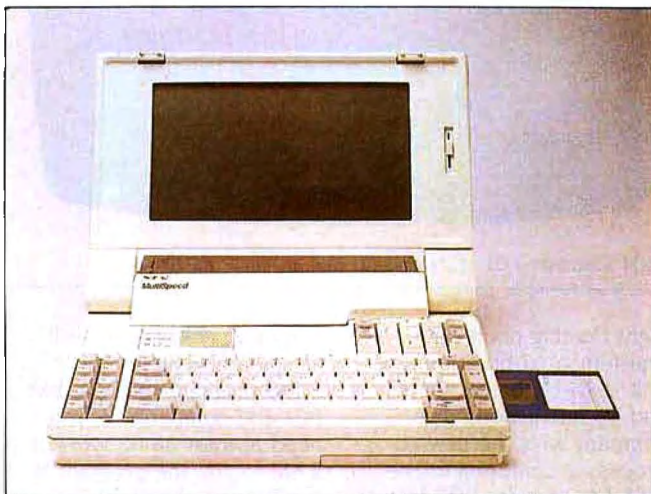
NEC Introduces Fast IBM-compatible Portable

NEC Home Electronics has released the MultiSpeed, its first IBM-compatible laptop computer. The computer has a 16-bit NEC V30 (8088-compatible) microprocessor running at either of two clock speeds: 4.77 MHz or 9.54 MHz.

The MultiSpeed features two 3½-inch 720K-byte floppy disk drives, a detachable LCD screen, and a built-in keyboard with a separate numeric keypad. The computer's memory is composed of 640K bytes of RAM and 512K of ROM. Included in the ROM are a number of desktop utility programs with windowing capabilities.

The MultiSpeed also includes a parallel port, serial port, and RGB display connector. The 80-character by 25-line LCD uses high-contrast "super-twisted pair" technology and features a resolution of 640 by 200 pixels. Battery life is said to be 6 to 10 hours.

The 11-pound laptop computer, which supports MS-DOS 3.2, has a retail price of \$1995. Options include an internal 300/1200-bps Hayes-compatible modem, two external 5¼-inch floppy disk drives, and a PC-compatible file transfer package. For more information, contact NEC Home Electronics (U.S.A.) Inc., Computer Products Division, 1255 Michael Dr., Wood Dale, IL 60191, (312) 860-9500. Inquiry 550.



NEC's MultiSpeed runs at 4.77 and 9.54 MHz.

Hand-Printed Character Recognition

Incorporate your own hand-printed characters into your applications with Handprints, a program that includes C and assembly language callable routines for character entry and recognition. The routines take up about 12K bytes of RAM, according to Skylight Software, the manufacturer.

Handprints runs on IBM PCs and compatibles and costs \$1200. Contact Skylight Software Inc., 2 Charles St., Bedford, MA 01730, (617) 275-2999. Inquiry 551.

Convergent's S/50 Workstation

Convergent Technologies introduced several 68000-based workstations, including the S/50, a 68010 machine that has an op-

tional IBM PC XT-compatible coprocessor.

The S/50, which has a base price of \$5500, supports five users under AT&T's UNIX System V release 5.2. Its system board, which operates at 10 MHz, is available with 1 or 2 megabytes of RAM, and its memory management system supports demand paging with 4 megabytes of virtual address space. Also included on the main processor board is a 300/1200-bps modem and circuitry to control two data lines and a voice line. Two tripping line jacks and one telephone jack are standard, as well as one RS-232C serial port and one parallel port. The board provides controllers for the machine's 5¼-inch floppy disk and hard disks, available in capacities from 24 to 85 megabytes.

An additional 2 megabytes of RAM, for a system total of 4 megabytes, can be added via the expansion

slots. The three available slots can accommodate a variety of options, including a coprocessor board (\$1000) that runs standard IBM PC XT software, a two-port RS-232C board, a combination RS-232C board with 1 megabyte of RAM, an Ethernet interface, and a controller for an external ¼-inch streaming tape drive.

The S/50 workstation comes with a keyboard, mouse, and 12-inch diagonal monitor that displays 80 columns by 29 rows and offers a resolution of 720 by 348 pixels. The system's software costs \$795, which includes UNIX and the firm's WGS/Office software, an integrated package that provides access to UNIX-based applications. The package includes a word processor, spreadsheet, calendar, and electronic mail system.

Among the other workstations in the series are the 68020-based S/120 and S/220, which support 12 and 22 users, respectively, at 12.5 MHz; the S/320 and S/640, which handle 32 and 64 users; and the S/1280, which can support up to 128 users at 8.8-MIPS performance levels. Contact Convergent Technologies, 2700 North First St., San Jose, CA 95150, (408) 434-2848. Inquiry 552.

Accounting on the Atari ST

The PayDay payroll program for the Atari ST is the first in a set of account-

(continued)

ing software announced by Crystal Software. According to Crystal, the program can handle a \$21 million payroll with up to 255 employees and is capable of printing monthly, quarterly, or yearly tax information. You can also print W-2 tax forms, employee lists, personnel information, mailing labels, and continuous checks.

A configuration utility enables you to adapt the program according to your state's tax and small-business laws. The program is menu-driven and offers context-sensitive help.

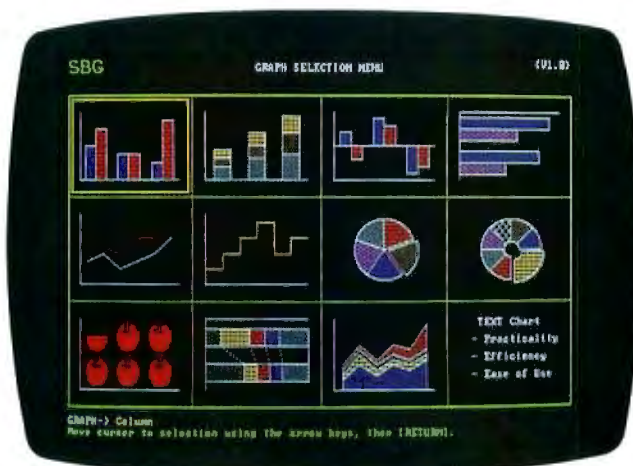
PayDay sells for \$69.95 and runs on the Atari 520ST and 1040ST with at least one 360K floppy disk drive. For more information, contact Crystal Software, P.O. Box 803, Merlin, OR 97532, (503) 479-9516. Inquiry 553.

Motorola Develops Successor to 68020

Motorola's Microprocessor Group announced the MC68030, a 32-bit processor that the company claims is twice as fast as the 68020 and is fully code-compatible with its existing 16/32-bit chips.

The chip, about $\frac{1}{8}$ -inch square, uses 300,000 transistors. According to Motorola, the 68030 is the first single-chip microprocessor to use the "Harvard-style" parallel architecture incorporated in some mainframes and supercomputers. The company claims the new device is the first 32-bit microprocessor to have on-chip instruction and data caches. The chip supports a synchronous bus interface with two-clock-cycle access and an asynchronous interface with one-clock-cycle burst access.

At the same time, the firm announced the MC68882, a 32-bit floating-point co-processor. This chip features



VCN Concorde 1.01 offers graphics and an image database.

eight floating-point data registers, a 67-bit arithmetic unit, a 67-bit barrel shifter, and 46 instructions. The company says the new co-processor conforms to the IEEE-754 standard for binary floating-point math.

Sampling and production for both chips are scheduled to begin in 1987. Final prices were not yet set at press time; the company estimates the chips will cost \$150 to \$200 in lots of 5000. For more information, contact Motorola Inc., Microprocessor Products Group, P.O. Box 52073, Phoenix, AZ 85072, (512) 440-2839 (in Austin, TX). Inquiry 554.

Business Graphics with Image Database

VCN Concorde version 1.01 offers business graphics, freehand painting, slide show and animation capabilities, and text generation. The package includes 16 fonts, 15 of which are proportionally spaced. Also included is Image Database, which contains over 2000 bit-mapped pictures. VCN Concorde works with word-processing and

graphics packages, as well as spreadsheets.

The program runs on IBM PCs and compatibles. You need at least 384K bytes of RAM to run the program in medium resolution and 640K for high resolution. VCN Concorde sells for \$695. For more information, contact Visual Communications Network Inc., 238 Main St., Cambridge, MA 02142, (617) 497-4000. Inquiry 555.

Software Library for Series 151 Image Processor

ITEX 151 is a subroutine library of over 200 image-processing and graphics routines designed for use with Imaging Technology's Series 151 Image Processor. The program includes board-level access and control routines, look-up table operations, image filtering and convolutions, graphics, image geometry, and statistical analysis.

The program is distributed as object code for MS-DOS systems and costs \$995. Contact Imaging Technology Inc., 600 West Cummings Park, Woburn, MA 01801, (617) 938-8444. Inquiry 556.

Paradise EGA Chip Has Higher Resolution

Paradise Systems has developed a single-chip Enhanced Graphics Adapter compatible with IBM's EGA that provides an extended EGA mode when used with continuous frequency monitors, like NEC's MultiSync. The chip, called the PEGA 2, offers a resolution of 640 by 480 pixels, in contrast to the maximum 640 by 350 resolution provided by IBM's EGA.

The 84-pin chip enables EGA software to run on standard monochrome and color monitors and enhanced monitors. It also permits EGA software to be emulated on monitors with 640 by 480 resolution (the same as that supported by the IBM Professional Graphics Controller) or 640 by 400 resolution (compatible with the AT&T PC 6300). The chip also supports the IBM CGA, MDA, and Hercules monochrome graphics standards.

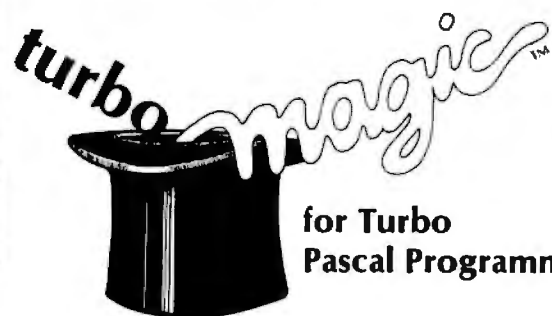
The firm will provide software developers with drivers for Microsoft Windows, GEM, and a variety of applications programs, including CAD, graphics, and desktop publishing packages.

Production quantities are slated to be available this year; the price is set at \$55 each in OEM quantities. For more information, contact Paradise Systems Inc., 217 East Grand Ave., South San Francisco, CA 94080, (415) 588-6000. Inquiry 557.

IBM Adds RAM, Storage to RT PC

IBM has introduced a new desktop model of its 32-bit RISC-based RT PC, called the RT PC 6151

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the fourth wall. The "ball" (which is square) bounces off the ceiling and walls. It will, however, sink into the floor and disappear unless you bounce it off your paddle: a square that you move around the floor with the mouse.

The three-dimensional effect is quite good. The program actually draws two versions of the game on the screen, one in red and one in blue. Each version corresponds to what each eye would see if the scene were truly three-dimensional. For the eye looking through red plastic, the pale red looks gray and the pale blue looks black; vice versa for the eye looking through the blue plastic. The background is a light purple, which looks gray through either color of plastic. The net effect is that the left and right eyes see two different two-dimensional images and your brain fuses them together into a three-dimensional scene.

The effect, while good, is not perfect. The "ball" is only two-dimensional, a flat square that grows and shrinks according to its distance from the front wall (the screen). That flatness tends to nullify some of the effect. Likewise, the program needs some adjustment as to when the paddle has actually hit the ball; the ball tends to sink through the back end of the paddle but easily bounces off the paddle's very front edge. Of course, that hasn't stopped me and the kids from putting in a fair amount of time on the game.

Tim was willing to correspond about the program and to sell the plastic material for the glasses. I suggest you write him (with a self-addressed stamped envelope and sufficient money to cover his time and effort) at Tim Kemp, P.O. Box 23101, Columbus, OH 43223.

STOCKING STUFFERS

By the time you read this, there won't be too many more shopping days until Christmas, and you may be wondering what to get for the computerphile in your life (even if that's just you). I don't talk much about games in this column, but I hope you won't mind too much if I make some recommendations for your last-minute Christmas shopping. Since computer games are something of a passion in this household, we've had a fair amount of experience.

My favorite game this year has been Major Motion, written by Philip MacKenzie and Jeffrey Sorenson for the Atari ST and published by Michtron. It was inspired by the video arcade game Spy Hunter and involves car-to-car combat. Your mission is to travel as far as you can, destroying enemy (blue and/or black) cars and helicopters as you go along while avoiding injury to civilians. Your car starts out armed with just guns, and they work only against some of the enemy. As you drive along, a red semi appears from time to time; if you drive into it, you come out with a new weapon (oil, smoke screen, repulsor, missiles for the helicopter, or turbo boost). Each new weapon is good for only three attempts, and you lose one of those weapons each time you crash. You start out with six cars and get a new one for each 10,000 points.

The enemy, of course, is not idle during all of this. One

(continued)

type of enemy car is equipped with tire slashers; if it bumps into your side, you're gone. Other enemy cars will try to run you off the road while the enemy helicopters drop oil spots in front of you. If you go far enough, you'll encounter your "evil twin"; if you get past him, you'll soon run into two of them. Somewhere past that you'll find the bridge is out, but...well, that would be telling.

The car, controlled by the mouse, handles very nicely, and the graphics are smooth and colorful. Also, the game plays background music (themes from *James Bond*, *Batman*, etc.) from time to time as you drive; a nice touch. The game has other features, like an abort key, pause and music toggles, and the ability to reassign the weapons keys. And, best of all, it keeps a "Top Ten" list that provides solid documentation for bragging rights.

I'm not sure why I like this game more than the others I've played. I think it has to do with the way I drive or, more precisely, the way I'd like to drive. And Major Motion had one welcome feature over the other two: it is not copy-protected. That helps, because my kids have already creamed one working disk, and it took me just a few minutes to make a new working disk from the master. I'd hate to think what would happen if they messed up the master disk for one of the other games.

Nevertheless, those two other games gave Major Motion serious competition. Both are superior in one way or another; I just didn't happen to get as hooked playing them. One is *Time Bandit*, written by Bill Dunlevy and Harry Lafnear for the Atari ST and also published by Michtron. This is easily the finest all-around arcade game to come out on a home computer to date. It is actually a collection of 16 different arcade games, 15 of which follow the same basic pattern: Once you get into it, you can't get out until you find the key(s) and unlock the gate(s) that bar your way. In the meantime, of course, all sorts of nasty creatures are trying to kill you by running into you. You can run, fire, or fire as you run. In an interesting

twist, the points you get for each creature you destroy vary according to your "bravery": If you just sit in a corner and blast away, the points-per-creature value drops; if you run at the things, the PPC value goes up. Each game has 16 levels, which get tough fairly quickly.

Interwoven into all this is an adventure game that lets you solve puzzles, find (and use) objects, and generally work toward an eventual goal. This adds a depth to the game that holds your interest even when the arcade elements grow old. Other features include a pause function (press P) and a "Time Lord" list that keeps track of the top six scores—the top five, actually, since it includes "Krazy Kev," who (allegedly) racked up more than 500,000 points. The only complaint I have is that there is no "Save Game" function, which is a significant shortcoming given the time it would take to completely solve the game. Even so, all the great features, as well as the outstanding graphics, make this game a must if you have an Atari ST (with color monitor).

The other competitor to Major Motion is *Marble Madness*, written by Larry Reed for the Amiga and published by Electronic Arts. This is a licensed port of the Atari video arcade game, and the graphics are really amazing. The basic theme is guiding a marble through a downhill maze. You have so many seconds to complete each maze; any time left over is then added to the time you have for the next maze. Various obstacles and enemies confront you as you proceed, the mazes get tougher, and the time for each maze gets shorter. You can use either the mouse or a joystick; for that matter, the game is designed to let you use a trackball if and when one becomes available for the Amiga.

I do have some gripes with *Marble Madness*. There's no pause function, so once you start a game, there's no way of stopping even for a second until the game is over. Even less forgivable, there is no "top scores" list, and once

(continued)

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this works fine (BCPL does this, which is why it works). If you are writing in C, then you must use PC-relative addressing and use a startup sequence that allocates a memory area for your BSS; you must not use any static initialized data because that makes your code nonreusable. Local variables are allocated on the stack; you get one of these for each invocation. If you don't use any global data then your code is OK; otherwise, you must use a compiler that can handle PC-relative addressing. [There is a big problem here in that the current version of Alink does not cope with the Xref(A5)-style of addressing so that Lattice users, at least, cannot use the two options that cause the compiler to produce position-independent code.]

If you think the problem through you will realize that simply copying the data area will, of course, not work because there are essentially absolute references in the code (created by the relocating of the code) to areas within the data segments. And altering these would mean that the code could still be used by only one user at a time.

The entire area of producing pure code on a 68K is complex; some systems (e.g., OS-9) require that all programs are position-independent, which I find very hard to take because the XXX(An) addressing mode limits one to 64K address bounds, which sounds a little too much like the dreaded 808x far me.

amiga/softw.devlpmt #2451, from jgoodnow
a comment to message 2443

Unfortunately, very few serious programs that do anything with windows or graphics can get by without some initialized data structures. That's what Crunch's gadget editor is all about.

amiga/softw.devlpmt #2455, from Inoland
a comment to message 2451

Though I know this is messy at best: How about if the initialized data were stored as a separate file, loaded by the program with LoadSeg and addressed via pointer de-reference. It's an awful way of doing things because it throws any concept of data hiding completely out the window, requires cooperation amongst all programmers on a project to a degree that goes beyond what is reasonable, and requires the programmers and compiler to perform a function that ought to be performed by the linker and loader. It would, however, enable one to write code that could be used with the resident feature and, hence, would be much more valuable to the user. Just a thought.

- Les Noland

amiga/softw.devlpmt #2458, from jdow
a comment to message 2455

Lattice is experimenting with residency using standard Amiga methods. Perhaps some day soon. (BLINK seems to perhaps handle the necessary linking formats.)
<^_>

amiga/softw.devlpmt #2476, from jmackraz (Jim Mockraz, Commodore-Amiga, Inc.)

a comment to message 2451

Question: If you don't _change_ your initialized data, isn't it OK to use it by multiple invocations? Intuition has a reference copy of each system gadget, which it copies to a dynamically allocated gadget when it creates a window/screen. The only big-time reason for initialized data in Intuition users is probably image planes, and copying them to dynamically allocated chip-mem isn't all bad (unless their size is too large

to duplicate). I think you can share image data that isn't going to change.
ramble ramble ...

amiga/softw.devlpmt #2460, from afinkel (Andy Finkel, Commodore)
a comment to message 2443

Actually, one user at a time is *fine* for compilers and editors, and...(the stuff you've been putting in your RAMdisks). Not keeping two copies around (one in RAMdisk, and one executing) is a win by itself (at least for me!). So only the static data has to go, right?

andy

ATARI

This month's look at the Atari ST conference begins with a thread of double-buffered animation techniques. The section continues with a question on controlling the RS-232 (serial) port and concludes with a comparison of graphics techniques for the Atari 8-bit and 16-bit computers.

DOUBLE-BUFFERING TECHNIQUES

atari.st/tech #706, from jim_kent (Jim Kent)

I was running some double-buffered animations on the ST, switching screens with Setscreen. This seemed to work pretty well except for a glitch that happened every minute or two. I wanted to clear this up without resorting to a wait for vertical blank, which could slow down the frame rate quite a bit. Well, if you make the high-order word of the start address the same for both screens (both screens in same 64K block of memory) then you don't get the glitch, which is apparently from the video register being half-updated when it latches. I had to shuffle around my memory management, but it seems to work, and no waits!

atari.st/tech #720, from cheath (Charlie Heath)
a comment to message 706

Ah, good idea. So you just store the low word?

atari.st/tech #732, from jim_kent
a comment to message 720

Actually, I still call Setscreen, but if you were talking to the chip yourself you'd just store the low word.

atari.st/tech #740, from mmallett (Mark E. Mallett)
a comment to message 732

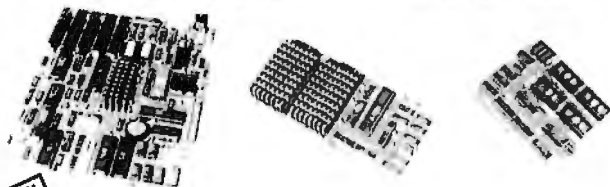
Does the ST have memory reserved for an alternate screen buffer? The Abacus documentation sort of implies that it does, because its examples show default values for a current and an alternate page. If not (Jim), how did you go about allocating two 32K chunks of memory that were both within the same 64K block, and not waste some memory?
-mm-

atari.st/tech #744, from jim_kent
a comment to message 740

As far as I know, the ST doesn't have a reserved second screen. What do I do? Well, there are some routines I

(continued)

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megatel

posted in listings - alloc and mfree - that I use for my memory management. Basically I use Malloc((long)-1) to see how much memory is there. I leave 32K for GEM, and malloc the rest of it for myself. Then I play some games to extract two screens in the same 64K block out of the big continuous chunk Malloc has given me, and put what's left back on my free list. It is a bit of a pain 'cause you can't use the start-up screen (in high memory) as one of your double buffers. When Deluxe Eggbeater ST crashes, it means that GEM thinks the screens are in the middle of the memory that Megamax uses for a stack. Scrolling the stack for a printf isn't a good idea. So I have to reboot after crashing when I use this memory method. However, now that I've got it to work, I went back to the old way for development.

Anyway, if you're very interested I can post the source. It is a little kinky, but worth it not to put waits into my draw loop!

atari.st/tech #747, from mmallett
a comment to message 744

No, I was just interested in whether you had some really elegant way of getting aligned allocated memory. I've had to use the same method that you described for other things as well.

-mm-

atari.st/tech #749, from agrimm (Steven Grimm)
a comment to message 748

You can point the screen anywhere on the ST by using Setscreen(). Just allocate 32K (I think it has to be on a 512-byte boundary) and away you go!

atari.st/tech #770, from jruley (John Ruley)
a comment to message 749

Does that work with GEM (i.e., can you change the screen pointer after GEM starts)?

atari.st/tech #777, from jim_kent
a comment to message 770

Yep, Setscreen works fine with GEM so long as you don't change resolution.

atari.st/tech #778, from jruley
a comment to message 777

Many thanks, Jim. That may just come in handy!

atari.st/tech #782, from mmallett
a comment to message 778

Does that imply that you cannot change resolutions in a GEM application, programmatically speaking? Why can you not do a Setrez, followed by appl_init, etc.? What happens? Doesn't this seem like a major deficiency? So what else is new?

-mm-

atari.st/tech #784, from jim_kent
a comment to message 782

Nope, can't change resolution with GEM about. It is maybe the biggest deficiency in this machine.

(continued)

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RS-232 HANDSHAKE CONTROL

atari.st/tech #802, from rchecketts (Rick Checketts)

How do I control the Atari ST RS-232 handshake lines from an application, notably the RTS line to make the modem hang-up, etc.? I have tried using Giaccess, Ongibit, etc., without much success. Can anyone give me a function call that will work?

atari.st/tech #805, from Jruley
a comment to message 802

Use the Rsconf(this,that,the_other)... this will let you turn handshaking on and off (it has a handshaking parameter) and will give you very tight control using the MFP registers. Hope that helps! — John —

atari.st/tech #811, from rchecketts
a comment to message 805

I have looked up Rsconf and, while I can see how to set it up to do the handshaking for you, I still cannot see how to control the lines myself. How, for instance, do I turn DTR on or off? Thank you in advance. —Rick—

atari.st/tech #812, from sgrimm
a comment to message 811

To turn DTR on:
Ongibit(0xffef);

and off:
Ongibit(0x10);

You have to #include <osbind.h>, of course.

8-BIT-TO-ST GRAPHICS

atari.st/tech #831, from stevesmith (Steve Smith)

As an avid fan of the old Atari 8-bit computers and a possible future owner of the new, I am particularly interested in the machine's graphics capabilities. I know basically that hi-res color is 640x200 with 4 colors, and that lo-res has 320x200 with 16 colors, but what else is there? Is any of the older hardware carried over, such as player/missile (sprite) graphics, etc.? Is there a 16-bit Antic display processor? How is the display memory configured? At a fixed location (like IBM) or can it be moved around anywhere in memory, like the old 800?

Please forgive all the ignorant questions, but I'm basically a video-game programmer who's been locked up in a Mess-DOS world for the last two years!

Any insightful comments would be most appreciated.

atari.st/tech #832, from bwebster (Bruce Webster, Consulting Editor, BYTE)
a comment to message 831

Steve:

I'm certainly not the most experienced ST graphics programmer (OK, guys, stop snickering), but I can probably give you the basics. No, there is no hardware assist (missile graphics, display processor) for graphics. There are a series of low-level graphics routines that you can call, which may save you the hassle of writing them yourself. Display memory can be configured on any 256-byte boundary and always takes up 32K. The graphics mapping is an interesting interlace approach. For hi-res (640x400x2), each bit represents one pixel on the screen, starting in the upper left corner and going across and down, i.e., the first 80

(continued)

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bytes represent the first row. The very first pixel (upper left) is the high-order bit of the first byte. For med-res (640x200x4), each pair of words represents 16 pixels; corresponding bits in those two words represent pixels. Confused? Well, if the screen is located at, say, \$78000, then the upper left pixel is represented by the high-order bit of the words at \$78000 and \$78002. Those two bits yield a total of four values, which are looked up using a color table. For lo-res (320x200x16), groups of four words are used; the upper left pixel is represented by the high-order bits of the words at \$78000, \$78002, \$78004, and \$78006.

..bruce..
(Did I get it right, guys? Huh? Did I? :-)) ..bfw..)

atari.st/tech #833, from jim_kent
a comment to message 831

Yes, we have no sprites, or no hardware sprites at least. There's no real equivalent of the Antic display processor. You can set up horizontal blank interrupts and do some of that stuff with the processor. Basically, the ST is just a real solid 68000 machine with 16 colors out of 512.

The display memory can be put on any 256-byte boundary. You can double-buffer. Scrolling is a little harder; in fact, you can only scroll horizontally 16 pixels at a time and vertically about 5 pixels at a time (or is it 8?). This is without moving data in memory. The 68000 will scroll vertically by moving memory at about 100 frames/sec, though.

The screen layout is "interleaved bitplanes." In 16-color mode this means that a pixel will be a bit in each of 4 consecutive words, 16 pixels in 4 words, the next 16 in the next 4 words. The color selection is 16 colors out of 512. The way this works is 8 levels each of red, green, and blue. Try to check out Neochrome and a couple of video games at a computer store.

atari.st/tech #834, from jsan (Jez San)
a comment to message 833

Jim -

How on earth do you hardware-scroll *ANY* amount on the ST?

You say that you can scroll 16 pixels at a time, and vertical 5 pixels at a time?

I know how to do it in assembly code, but are you saying there is a hardware function that scrolls the screen?

— Jez.

atari.st/tech #835, from jim_kent
a comment to message 834

Jez, I am sleepy. Come to think of it you can't scroll horizontally without moving memory, and even then you can only do it quickly 16 pixels at a time. To scroll vertically you have to figure out the least common multiple (or is it greatest common denominator) of 80 (bytes per line in the screen) and 256 (the screen alignment BS) and just set the screen pointer where you want. If I hadn't been up all night I'd figure out if this was 5 pixels or not.

atari.st/tech #836, from jim_kent
a comment to message 835

Actually in a color mode it's 160 bytes/line. $8 \times 160 = 1280 = 16 \times 16 \times 5 = 256 \times 5$... so moving the screen pointer 8 lines down will also be on a 256-byte boundary, 16 lines in monochrome. Sort of course scrolling, but not much overhead. Lets see, $200/8 = 25$... so 25 steps to scroll off the screen. If you timed it so it took less than a second it'd probably look pretty smooth even.

atari.st/tech #837, from mpack (Don Milne)
a comment to message 835

Aw, and I hoped you were going to give me a hardware method. Is there any quick way to scroll portions of the screen (i.e., without moving every word yourself)? Restricting it to byte or word boundaries is no problem.

—Don Milne.

atari.st/tech #841, from chrlakuku (Christoph Kukulies)
a comment to message 837

There is no way to scroll by hardware on the ST. You have to do it all by yourself (MOVEs) or use the appropriate GEM or bitbit line-A functions. See earlier discussions in this topic. There is also a way to manipulate the video controller register, but I haven't gone happy with that. You cannot scroll portions by this means and screen wraps are difficult to handle. I've written a VT100 emulator that also emulates the single- and double-width characters, three different fonts (one copied directly from the VT100-character ROM), and I did all scrolling, full screen and partial (in windows), by hand, by using assembler mixed with GEM, line-A and AES functions. The resulting scrolling in the windows still doesn't look overwhelming, so I wished we had a hardware scroll, too.
Chris

atari.st/tech #866, from dmichael (DeCarte Michael)
a comment to message 831

If you are into games, wait a little while until a bigger selection comes out. By then the prices may come down some more and there will be a bigger selection from programmers that have had the benefit of hacking on the ST for a year or two and can teach it to do some really nice things. (To see what I mean take a look at the old Atari 800 games, then look at the newer ones. There is a big difference, right? It comes from hacking a long time on a computer.)

atari.st/tech #869, from jimomura (Jim Omura)
a comment to message 866

Welllll. It also comes from the fact that memory got cheaper so more people started to buy bigger computers. Some of the early stuff for many of the early home computers were actually quite amazing when you look at them in detail. Just a couple of examples that I don't feel have *ever* been surpassed within the confines of the hardware they were designed for are the original Star Raiders, Tandy's Skiing for the Color Computer, and Tandy's DinoWars, also for the earliest Color Computer.

IBM PC AND COMPATIBLES

The IBM section begins with an unusual problem: A user finds that his IBM isn't compatible with his clones! BIXen quickly come to his rescue. The section continues with a look at the issue of "parking" the heads of hard disks. An assembly language program for parking heads, with instructions on compiling it from Debug, is included.

THE CLONE WARS

ibm.pc/hardware #1137, from jsprowl (Jim Sprowl)

I ran into an interesting headache today. A program that has been running happily for several weeks on

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IBM AT 339	IBM, 8 MHz	80286 CPU	2.898	3.79
COMPAQ 286	Deskpro 286, 8 MHz	80286 CPU	2.987	3.70
IBM PC AT	IBM, 6 MHz	80286 CPU	3.913	2.01
Zenith 140	Zenith, 8 MHz	8088 CPU	6.643	1.65
Zenith 150	Zenith, 8 MHz	8088 CPU	8.212	1.34
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The program costs \$395 and runs on IBM PCs and compatibles with one floppy and one hard disk drive, 128K bytes of RAM, and MS-DOS or PC-DOS 2.0 or higher. You also need a printer that can print at least 132 characters per line. With the EasyPlus Windowing System, you'll need at least 256K bytes of RAM, although the manufacturer recommends 512K.

For more information, contact Computer Associates In-

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PowerPlan ST works with monochrome or color monitors and sells for \$79.95. For more information, contact Abacus Software, P.O. Box 7211, Grand Rapids, MI 49510, (616) 241-5510. Inquiry 600.

Atari ST Desktop Accessory

Fast is a desktop accessory that sells for \$49.95 and is accessible from within any GEM program, according to Migraph. Included is ST DOS, which lets you perform the most common DOS commands. An ST editor has search, replace, block editing, and other editing features. Its card file is a database set up as an address book that you can configure. A calculator, calendar, ASCII table, and clock are also included in Fast.

The program operates in low, medium, and high resolution, and you can change many of its parameters to suit your needs.

For more information, contact Migraph Inc., 720 South 333rd St., Suite 201, Federal Way, WA 98003, (206) 838-4677. Inquiry 601.

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drive), but I'd probably have trouble making the AT&T talk to it.

One conclusion is obvious: if you want to run UNIX on the PC 6300 Plus, for heaven's sake get the largest hard disk you can buy. A hundred megabytes wouldn't be too small, especially if you intend to run it under DOS as well. I've got a 20-megabyte hard disk in Big Kat, and I've filled that under DOS alone. UNIX is big—far too big for a mere 20-megabyte disk.

At this point I'm stymied. I could, I suppose, reformat the hard disk, erasing UNIX and turning the machine into a pure DOS device—except I'm scared by the legalese paperwork. I don't suppose it's worth the effort. I'd only have the system for 90 days even if I went mad and signed that paper. I don't much want a monochrome system anyway.

Fortunately I saved all the boxes.

The sad part about all this is that I suspect the PC 6300 Plus is a good machine, and that if I had a color screen and a larger hard disk I'd like it a lot. The Los Angeles Science Fantasy Society has a PC 6300. As you'd suspect, LASFS being a science fiction club has attracted a fair number of wizards and hackers, and they're all very happy with the club's AT&T machine. Most people I've talked to about the color version of the 6300 Plus are quite favorably impressed.

On the other hand, I'm beginning to wonder whether AT&T will ever learn much about marketing.

Atari Faire

Atari has sponsored a series of Atari Faires. The one I went to was held in the San Jose Civic Center. I'm told about 5000 people came. Certainly the place was packed the Sunday afternoon I was there. The atmosphere reminded me of the early days of the West Coast Computer Faire. Lots of excitement.

The most interesting exhibit was Atari's, where they displayed an ST with a blitter chip installed. A blitter is a hardware graphics-manipulation device that speeds up animation something wonderful. It's supposed to be available for dealer installation—it takes soldering—about the time you read this.

Meanwhile, there was a lot of new software and the promise of even more. At the FTL booth you could fly a fighter plane. So could the chap at the machine next to you. The machines were linked through the MIDI port, so that you could see, and shoot at, the plane controlled by the other guy. The program is called RPV, which stands for remotely piloted vehicle.

Michtron had the arcade game Dragon's Lair set up. That is, the Atari ST controls

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a Pioneer laser disk player. You have to get the Dragon's Lair laser disk from a different outfit. When Dragon's Lair first came out I would probably have put some quarters into the system, but fortunately for me the game was so popular I could never get close to it. Now I have a copy, complete with laser disk—and so far haven't had time to play it. Real Soon Now. But I know it works. I saw it at the Faire.

Paul Heckel was demonstrating a new version of Zoomracks; that's a program that reminds me a lot of the Execuscan

Scan Card system, only this works on a computer. I've already recommended Zoomracks; now they've added a bunch of new features to make it even better.

Magic Sac

There was also MacCartridge. It's now called Magic Sac One. What this does is turn your Atari ST into a reasonable facsimile of a Macintosh; that is, a lot of Mac software, including Excel, runs fine on the ST plus Magic Sac. It even runs about 20 percent faster. They don't have MacWrite running just yet, but they're more than

half way to it. (It seems the MacWrite developers didn't follow the MacRules.) Magic Sac Plus contains a real-time clock and calendar. Both Magic Sac One and Magic Sac Plus include transfer cable to get software from Mac to Atari.

A few notes of caution. First, not everything that runs on a Mac can be made to run on the Atari ST, although in general all software that follows the Mac developer guidelines will. Second, you have to get the Mac software into Atari ST (standard IBM 3½-inch) disk format. This is simple enough unless the Mac program is copy-protected. Finally, you need Macintosh ROMs, and David Small and company, mostly from fear of legal action by Apple, don't sell them.

Not that getting those ROMs is a problem. There were at least two dealers at the Atari Faire who offered Macintosh ROMs for about \$30. As to software, it's not that hard to link up the ST to a Mac and port software over. There's plenty of public domain software available on bulletin boards.

There's also what can only be called pirate copies of commercial programs. These, I'm pleased to say, aren't being sold, and those who have them have been pretty careful not to pass them along to people who haven't already bought a copy of the original program. I suppose eventually that will get out of hand; the remedy is for the software publishers to make Mac software available in Atari ST format. I expect that will begin happening just about the time you read this.

Porting software to Magic Sac has shown some instructive lessons. For example: a great deal of Mac software writes to memory location 0. This is expressly forbidden for Mac software, but as it happens you can get away with it, since there is writable RAM at that location. The ST, however, has ROM at location 0, and any attempt to write there causes an instant bus error. Properly written Mac software won't do that, but some Mac software manages to pass a Nil (zero) pointer to a system call and survive. There are other such incurable glitches; but well-behaved Mac software really does run on the ST.

Whenever I write about the Magic Sac, I get mail protesting that there's something unethical about it: Apple spent all that money developing the Mac operating system, and Magic Sac turns a low-cost Atari ST into a machine that can run the Mac software, and even do it faster. Is this fair?

The interesting part is that few of those who think this way are unhappy about the flood of PC clones on the market. Indeed, most of them revel in IBM's discomfort.

As for me, this always has been the User's Column. I'll always be for anything that benefits users and isn't illegal. Magic

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CHAOS MANOR

Sac will let you run about 500 Macintosh programs on the ST, and they're constantly expanding that base. I like it. Now if they can only get MacInTax ported over to it...

Atari Faire Wrap-up

I collected a good deal of software. Alas, I left from the Atari Faire to go to Washington, returned from Washington to the PC Faire, and had enough to keep me busy the week after that; consequently, I have collected a pile of Atari stuff I haven't been able to run yet.

One thing I should comment on is Antic's CAD-3D, which they were demonstrating coupled with a pair of goggles. The goggles are electronically controlled to blank out each eye in alternation. This is synchronized with what's painted on the screen. The result is startling. Things really jump out of the screen at you. It flickered too much to be comfortable for me. Gary Yost, Antic's marketing manager, told me that was due to the fluorescent ambient light in the room. Could be; I haven't had a chance to see it anywhere else. By next month I ought to have my own. (Update: I do now—and it still flickers.)

Antic also supplied me with a mess of demonstration programs of objects like pentagrams and dodecahedrons rotating in three dimensions; very impressive.

In my judgment, the ST really is the machine "for the rest of us." It's fun, it's powerful, and most of us can afford one.

PC Faire

It was quite a week: I went from the Atari Faire to Washington for a meeting of the board of the Space Academy, then back to San Francisco for the PC Faire.

That turned out to be larger than the Atari Faire, but not *that* much larger. Mostly it was dealers with blowout sales.

There were a few new items. I went around collecting stuff, but since this was after the Atari Faire I had even less chance to check things out. Real Soon Now.

One thing that impressed me is a program called Point Five. This bills itself as "The First Word Processor for Numbers," and my first cut shows nothing to contradict that. Point Five has 150 math functions, including the ability to invert matrices.

My first attempt to program a computer was writing a matrix-inversion program for the IBM 650; I was part of the grade-prediction project at the University of Washington. Matrix inversions can produce systems of multiple regression equations, which can be highly useful if you're trying to make complex statistical predictions. I haven't tried Point Five for that, but I see no reason why it wouldn't work.



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Jobs award) goes to Commodore Business Machines. CBM took a potentially very hot machine—the Amiga—and did just about everything wrong that they could in selling it. Examples? Pushing a not-quite-finished machine with a not-quite-finished user interface and a not-quite-finished operating system onto the market. Poorly conceived advertising—when there was advertising at all. Avoidance of just about every major trade show, even though Jerry Pournelle described the crowds around the Commodore booth at COMDEX/Atlanta—the one major show where CBM did make an appearance—as being in a “feeding frenzy.” Alienation of third-party developers during several critical months. Internal confusion as to just what market the Amiga was aimed at. Despite all that, Commodore has managed to sell about 150,000 systems worldwide, about the same as Atari, and has actually outsold the ST in North America. Imagine how many Amigas CBM might have sold if they had done things right. The runners-up are IBM, for not having the foresight to see that low-powered, high-priced hardware would not thrive in the highly competitive business/MS-DOS marketplace; Apple, for bringing out the IIGS at too high a price and in too limited a quantity; and MicroPro, the makers of WordStar, who have managed to take what was a dominant position in the word-processing market and completely squander it.

The 1986 Fritzie for Best Recovery from Self-Inflicted Wounds goes to John Scully and Apple. Apple appears to be doing its best to turn things around from the misdirection of the past few years. The IIGS should have been brought out a few years ago, when Woz was originally working on it, but better late than never. And even with the problems mentioned earlier, it's still a positive step. The Mac Plus—which is what the original Mac should have been—is selling extremely well. And the much-rumored open Macs should help to entrench Apple as the main alternative to IBM cloning. The runner-up is Jack Tramiel, who took a near-moribund Atari and turned it into a profitable enterprise delivering what is probably the best price/performance system (the 1040ST) in the industry.

The 1986 Fritzie for Best Dying Industry Issue goes to copy protection, which appears to be on the way out. Lack of copy protection has become a selling advantage, with many consumers simply refusing to buy any product that is copy-protected. The continuing sophistication of “backup” programs allows those most interested in pirating to do so. And major publishers like Microsoft are announcing removal of copy protection from their products. The runners-up are Apple's legal threats against competing firms with Mac-like user interfaces and the “Real Men Don't Use Icons/Menus/Mice” retrenchment.

The 1986 Fritzie for Worst New Industry Issue goes to IBM's much-rumored proprietary operating system. For more than a year now, the ever-infamous industry analysts have been predicting that IBM would release a new line of computers using a proprietary operating system. It hasn't happened as of this writing, though it may yet (see below). My reaction: Who cares? If IBM does it, they will most likely just isolate themselves from the largest marketplace, in which they can't really compete anymore anyway. IBM isn't going to fold; neither will they magically capture the entire software industry and the *Fortune* 1000 with a proprietary operating system. The runners-up are any other IBM rumors that have surfaced recently or might surface in the coming months.

The 1986 Fritzie for Best-Kept Secret goes to the burgeoning market for synthesizers and other electronic instruments. These wonders are hot, cheap, and seductive. For the price of a home computer, you can get an electronic keyboard that plays dozens of instruments and (in most cases) can be hooked up to your computer for further tricks. Go pick up a copy of *Electronic Musician*. A subscription to *Electronic Musician* (5615 West Cer-

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amiga/softw.devlpmt #2667, from jdow, Mon Sep 15 15:22:44 1986. A comment to message 2665.

That's right. Very easy to do. You only have to close the serial device and reopen it when you need to change from standard to 7-wire control. Not dropping DTR is odd. That is the same program as Aterm at its core. Some of the code can be vastly improved; but it does close things on the way out as I remember, so DTR should drop. (It opens the serial in shared mode twice, once for read and once for write. Best be sure it closes both.) I have massaged the serial device handler greatly here and am 90% finished gaining GREAT control over the serial port for Aterm-derivative programs. I don't know whether I'll patch it into VT100am or make the rest of the beast my own development. Maybe some of both. VT100am seems a bit, er, organic for easy modification. Aterm was even worse... <^_>

amiga/softw.devlpmt #2668, from afinkel (Andy Finkel, Commodore/Amiga), Mon Sep 15 17:41:16 1986. A comment to message 2665.

DTR should be dropped when the serial device is closed. There were parity problems in v1.1. Those have been fixed for v1.2. (For those who noticed, and calculate parity in your own terminal programs, please make sure you turn off parity when doing your own. Because funky things will happen when we both do parity at the same time, right?)

amiga/softw.devlpmt #2688, from skbower, Thu Sep 18 22:11:25

Well, guys, thanks for all the info and speculation about my DTR problem! I just went down and got myself a funny little connector with a switch on it that connects/disconnects the DTR line; works fine. Somehow, though, it just doesn't feel very satisfying to have this thing. Something about making an elegant solution that you can call your own (i.e., through software). Ah, well, I guess I'll learn to live with it!

ATARI ST

The Atari conference excerpts cover a wide range of applications. The first question concerns reading the arrow keys from C. Next, there is a description of the file format used to store pictures created by DEGAS. Finally, there is a discussion of the problems and benefits of using an Atari ST as an instrument control computer for the laboratory.

READING THE ARROW KEYS

atari.st/questions #515, from jim_kent (Jim Kent), Fri Sep 12 05:28:42 1986.

Anyone know of a good way to read the arrow keys? I've tried Ccrawin, but it just ignores them.

atari.st/questions #516, from sprung (Ron Sprunger), Fri Sep 12 09:25:00 1986. A comment to message 515.

Jim, I was going to ask *YOU* how to read the arrow keys.

atari.st/questions #521, from jim_kent, Fri Sep 12 14:27:59 1986. A comment to message 516.

Ahh, I figured it out. Cconin/Crawin return a long. The low word contains the ASCII value, if any. The high word is 0 for most keys. However, for the arrows the low word is 0 and the high word is things like 0x4c, 0x4d.

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BEST OF BIX BIX BEST OF BIX

atari.st/questions #522, from mpack (Don Milne), Fri Sep 12 14:57:46 1986. A comment to message 515.

Do you get nothing with Ccrawin, or do you get NUL? You may have to use assembly, 'cause what you need is in high word of the BIOS return longword (you want the scan code).

Suggest you do it this way:

```
/*.....*/

char rawread(scancode)
int *scancode;
{
    char c;

    asm{
        move.w #7,-(sp)
        trap #1
        addq.l #2,sp
        move.b d0,c
        swap d0
        move.w d0,(scancode)
    }
    return(c);
}

/*.....*/
```

So you get the char back as the function result. Then, if it's NUL, you should check the scan code. The scan codes returned for the arrow keys are 4BH=up, 50H=down, 4BH=left, and 4DH=right.

Does that help? (Now back to M2 mode....)

atari.st/questions #524, from jim_kent, Fri Sep 12 16:03:03 1986. A comment to message 522.

Exactly. Only it's even simpler than that since Cconin already returns the long (at least from the Megamox C binding).

DEGAS PICTURE FILE FORMAT

atari.st/questions #577, from dmick (Dan Mick), Sat Sep 20 13:57:04 1986.

If this has been discussed, point away, but here goes:

What's the format of a DEGAS picture file (or, as I understand there are different types, in particular the 320x200 4-color version)? If you could explain in terms of colors and pixels without using ST lingo, I'd appreciate it, having never seen an ST. I'm gonna try to make an IBM version of a DEGAS reader. It's not IFF format, right?

atari.st/questions #578, from jruley (John Ruley), Sat Sep 20 14:44:46 1986. A comment to message 577.

No, it's not IFF format. The format is 2 bytes resolution + 32 bytes color map + 32,000 bytes direct screen dump. It's really an extremely simple format to implement - on an ST. For another computer you'll have to decode the screen dump data. --- John ---

atari.st/questions #579, from dmick, Sat Sep 20 15:20:37 1986. A comment to message 578.

Is the extension somehow significant, or is that just for user convenience?

atari.st/questions #580, from jruley, Sat Sep 20 18:26:02 1986. A comment to message 579.

Most programs use the extension as an identifier - if you are in high res, for instance, only the files with a ".PI3" extension will show up in the file selector. In effect, this makes the resolution data in the first data word redundant. --- John ---

continued

atarl.st/questions #582, from jim_kent, Sat Sep 20 22:54:58 1986. A comment to message 580.

Anyway, you've got an EGA, right? The format for a .PI2 file is so:

byte 0 - 0 byte 1 - 2

Bytes 2 through 33 have the colormap. This is grouped by words in Motorola format (high-order byte first). In the .PI2 file, only the first four of these 16 words are significant. They hold the RGB values of the four colors in the format so that: white = \$777(hexadecimal), black = \$000, red = \$700, green = \$070, yellow = \$770, etc., with, say, a dark blue being \$007, \$557 being a pastel blue.

Then we get to the fun part: the pixel data. These are represented as two word-interleaved bitplanes. The words are again Motorola words (you might have to swap bytes, or even make bit 0 bit 15, bit 1 bit 14, i.e., mirror the bits). Don't know the EGA format.

The two words contain the pixel data for the first sixteen pixels, starting from the upper left and going right. The pixels are ordered right to left, top to bottom. The high-order bit (bit 16) of the first word together with the high-order bit of the second word make a 2-digit binary number that indexes into the color map.

atarl.st/questions #584, from dmick, Sun Sep 21 23:38:52 1986. A comment to message 582.

Two clarifications: Do you really mean right to left, or do you always reverse that, like me? Most graphic screens go l-r, which doesn't mean anything, but I's just checkin'. Second: Do you mean the screendump data is two words of 16 bits, one word for each color bit? That is, not only the hi bit, but all bits, form the color of that pixel, regardless of color code in the first word? I assumed that, but you only said the hi bit. (Nitpicker, I know, but I hate redoing good code trying to fix an error with the description, and I'm just not quite sure. Surely, all 16 bits don't have to be the same color, though.)

atarl.st/questions #585, from jim_kent, Mon Sep 22 00:31:04 1986. A comment to message 584.

It goes left to right.

I'm no good at making generalized descriptions when there's no basic vocabulary to start with. Let me give you an example.

If the first two words are %0011000000000000, %0110000000000000 (where % means binary), then the first four pixels are color 0, 1, 3, 2. The next twelve are zero. Frankly I'm a little dyslexic. The first four may be 0, 2, 3, 1, too. If someone knows for sure, say so. I have to experiment both ways every time I do it.

atarl.st/questions #586, from dmick, Mon Sep 22 02:00:55 1986. A comment to message 585.

Thanks. That'll be enough to experiment. (Fascinating to find someone else who says r-l when 'e means l-r! Can be a real problem, can't it?) Since Omura's picture of Bob Brown isn't up yet, I'm gonna play with the PICTURE.00x files. They don't have .PI2 extension or 0002 as the first word, but they are just big enough. I suspect it's a different number of colors, as the color map has more entries, but I'll forge ahead just interpreting any color as on, and 00 as off, unless someone knows what format *they're* in. (hint!)

atarl.st/questions #587, from al (Alastair Mayer), Mon Sep 22 11:33:31 1986. A comment to message 586.

If they're in lo-res mode (16 colors), then you take the 1st bit of each of the first *four* words as the color of the first pixel, the 2nd bit of each of the first four words as the color of the 2nd pixel, and so

on. (Who dreams these mapping schemes up, anyway? I've yet to see a personal computer on which they made sense from a software standpoint (no doubt they make sense to the hardware). Give me a word-per-pixel machine!)

atarl.st/questions #588, from dmick, Mon Sep 22 18:02:10 1986. A comment to message 587.

Well, if you load the bitplanes (or dump them) one at a time, makes perfect sense, no? Problem is I can't access bitplanes like that on the IBM. I betcha can on the ST or the Amigoid, though. Thanks for the info. Is lo res defined as a "0000" in the first word, then a longer colormap? I doubt these PICTURE.000-.016 files are DEGAS format, actually, but they're bitmap of some kind. Tony tells me BBrown's picture is up, so I'll let you know how well your advice (well, Jim Kent's advice) did. Thanks, all, again.

atarl.st/questions #589, from batteriesinc (Mark Skapinker, Batteries Included), Tue Sep 23 16:27:26 1986. A comment to message 577.

If you look in the back of the manual, we have a full description of the format. DEGAS Elite - our new version, supports IFF for partial screens/blocks. It is described in the back of the new manual - IFF to DEGAS is possible as well within the program. If I may ask, why are you making an IBM version of a DEGAS reader?

atarl.st/questions #590, from al, Tue Sep 23 16:29:22 1986. A comment to message 589.

I believe he wants to be able to look at pictures that are uploaded in DEGAS format.

atarl.st/questions #591, from dmick, Wed Sep 24 01:07:51 1986. A comment to message 589.

Sure you may ask. I'm trying to display DEGAS-created pictures on an IBM, and I don't own DEGAS, an Atari, or Amiga, or Deluxe Paint, or... (see, now aren't you sorry you asked?)

atarl.st/questions #592, from dmick, Wed Sep 24 01:37:52 1986. A comment to message 587.

Is that 0001 resolution ID, and then what pixel dimensions? I think the .PI2 file is not a .PI2 file, Jim Omura. It has a 0001 in the first word. Um... Would someone please do a little summary of bits/pixel vs. ID words for the different .PIx files? (I'd appreciate it if someone would.) Thenkew.

atarl.st/questions #593, from jimomura (Jim Omura), Wed Sep 24 09:37:17 1986. A comment to message 592.

No, it was definitely .PI2. Batteries Included has allowed me to quote from their manual, so:

Screen resolution indicator:

"This is a WORD value which indicates the resolution of the picture to be dumped. A zero in this indicator means that the picture is a 320x200, 16-color picture. The number 1 in this indicator means that the picture is a 640x200, 4-color picture. The number 2 means that the picture is a 640x400, monochrome picture."

atarl.st/questions #594, from batteriesinc, Wed Sep 24 13:17:16 1986. A comment to message 591.

Are you doing this under GEM? (No real reason I asked, just interested.)

atarl.st/questions #596, from dmick, Thu Sep 25 11:16:45 1986. A comment to message 593.

640x200! I had thought you said 320x200. Okay. Thanks.

atari.st/questions #597, from dmick, Thu Sep 25 11:17:19 1986. A comment to message 594.

Nope. DOS. Turbo, for ease of access.

AN ATARI FOR INSTRUMENT CONTROL

atari.st/tech #942, from sgrant (Steven Grant), Sat Sep 6 21:37:09 1986.

I am considering using an Atari ST or an Amiga in my laboratory for data acquisition and instrument control. I have used an Apple IIe for several years for these tasks, but I would like a faster system and a larger memory space. However, to make the port worth my time, the major system improvement I require is that interrupts are not disabled during a disk operation as in the Apple IIe and the IBM PC. I would like to be able to double-buffer my data, and thereby write to disk without missing any of the incoming data. Is this possible on the ST or Amiga? Second, does anyone know of a digital-to-analog converter board for these machines? Finally, my instrument control needs are rather simple; each bit on a parallel port either turns a device on or is a signal from that device that it is on. Do either the Atari ST or Amiga have the requisite hardware or expansion capabilities for this type of I/O? Thanks...Steve

atari.st/tech #943, from al, Sat Sep 6 21:56:15 1986. A comment to message 942.

Just off the top of my head, I imagine the Atari can handle it, perhaps with some kludging. After all, it handles the mouse input (i.e., position sensing) during disk I/O. You could use that port for input with a bit of programming, or the parallel (printer) port.

Don't know about boards. I'd be interested in that info myself.

atari.st/tech #971, from jtittsler (Jim Tittsler, Atari Corp.), Thu Sep 11 02:06:03 1986. A comment to message 942.

One company whose product I have seen demonstrated is G/P-Elektronik. They take an ST out of its case and mount it and a floppy or two (their brochure also indicates the availability of hard disk versions) inside a metal case especially for control applications. They saw off the front of the ST to create a detachable keyboard. The result is a pretty rugged looking 68000-based controller. They have a chassis that allows the installation of modules that contain digital I/O ports, 8 channels, 12-bit analog inputs, and 2 analog outputs. If you would like more information, I suggest you contact them directly: Ingenieur-Buro F. Godler, G/P-Elektronik, Schoenleinstrasse 12, D-1000 Berlin 61, West Germany, Tel.: (030)691 25 09 or 694 34 67

atari.st/tech #972, from jtittsler, Thu Sep 11 02:14:50 1986. A comment to message 942.

If your application is straightforward, and only needs a limited amount of parallel I/O, you might try using the printer port. On the ST computers, it is bidirectional (although at any given time all of the bits must be going in the same direction). You can also use the printer STROBE for output control and the printer STATUS line for on input. The STATUS bit is very easy to read/count. Slow speed sampling could be done using the Joystick Fire Button Monitoring mode which will give you about a 6-kHz sampling of a single input bit (at the expense of other keyboard functions). For high-speed applications, the AHD1/DMA port is probably the best way to go.

atari.st/tech #946, from hisoft (Andy Pennell, Hisoft), Mon Sep 8 13:28:20 1986. A comment to message 943.

There is an ST D/A converter available for 80 pounds (UK) or so, which plugs into the cartridge slot. Don't

continued

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know anything else, except that the company (2-Bit Systems) is a DevpacST customer, so they've got to be good. I'll try to get more info.

atari.st/tech #948, from sgrant, Mon Sep 8 17:18:50 1986. A comment to message 946.

Thanks for the info. Also, can the cartridge slot be used as a poor man's bus?Steve

atari.st/tech #950, from jrahn (John Rahn), Mon Sep 8 23:53:12 1986. A comment to message 946.

Am very interested in that D/A converter -- any more information will be appreciated.

atari.st/tech #952, from chriskuku (Christoph Kukulies), Tue Sep 9 02:59:35 1986. A comment to message 946.

Do you mean D/A or A/D? D/A shouldn't be a problem. I guess you meant fast (12-16 bit) A/D.

atari.st/tech #949, from jsan (Jez San), Mon Sep 8 18:21:53 1986. A comment to message 948.

Steve - The cart port CAN be used as a poor man's bus. Except... a) It has no read/write line! b) It is limited to only 128K addressing. c) Even if it HAD a read/write line, Atari engineers have ensured that all writes to this area of memory are blocked by the Custom Memory Controller chip! (To ensure pirates can't use RAM as ROM, I assume!) -- Jez.

atari.st/tech #951, from sgrant, Tue Sep 9 01:26:11 1986. A comment to message 949.

Well, if you can't write to the cartridge slot, then it's a neat trick to initialize a hardware device such as an A/D converter. I wonder how they do it? Again, where might I at least find an ad for this company?Steve

atari.st/tech #954, from jsan, Tue Sep 9 06:42:45 1986. A comment to message 951.

Sgrant -

Using sneak hardware addressing, you can use the chip select lines to talk to your devices... e.g., whenever address 'X' is on the address bus, AND 'chip-select' is asserted, then you can enable your device! That is, only a 'READ' is necessary to activate! -- Jez.

atari.st/tech #955, from al, Tue Sep 9 20:06:22 1986. A comment to message 951.

There are ways to do it if you don't need the whole address space of the cartridge port. Just treat some of the address lines as write lines. That is, you initialize something by 'reading' from a nonexistent address, which gets decoded by whatever's in the cartridge slot. The 'soft switches' in the Apple II work something like this.

atari.st/tech #957, from sgrant, Tue Sep 9 22:58:35 1986. A comment to message 952.

Yes, sorry; I meant A/D, not all that fast. Less than 250-1kHz sampling would be fine, and multiple channels would be best.

POWER SUPPLY PROBLEMS

ibm.pc/clones #274, from j.mott (Jim Mott), Fri Sep 12 22:55:09 1986.

I recently purchased a locally manufactured XT compatible (BEST Mk II) and immediately experienced a problem with the RT clock. The date and time would be maintained throughout a hardware reset (reset button) and a Ctl-Alt-Del, but not a powering down and up. After much fiddling around, the salesman told me that the multi-function card would have to be located in either the first or last slot. Because of the way the power supply is "split," a powering down will interfere with the clock when it is located in a middle slot. This solved the problem.

Has anyone heard of this before? Can anyone offer me a lucid explanation of the problem? I am really wondering whether I should be concerned. Can the performance of any other add-on boards be affected detrimentally?

Another disturbing characteristic of this power supply is the short, harsh buzz that it occasionally makes when powering up.

ibm.pc/clones #275, from barryn (Barry Nance), Fri Sep 12 23:05:44 1986. A comment to message 274.

That *is* odd. On IBM motherboards, and on most clones I've seen, the P8 and P9 power connectors lead from the power supply to the board right next to slot #8. That power (+12V, +5V, -5V, -12V) is fed across the board and should be available equally to all the slots. There's nothing special about the 8 slots, except that (on IBM XT's) slot 8 has a few timing differences that make it special. The technical specs for the other 7 slots say that their electrical characteristics are identical.

ibm.pc/clones #278, from cdanderson (C. David Anderson), Sat Sep 13 14:57:07 1986. A comment to message 275.

But doesn't the order in which the cards are placed in the (identical) slots sometimes make a difference?

ibm.pc/clones #279, from barryn, Sat Sep 13 15:13:05 1986. A comment to message 278.

The slots in an IBM PC are electronically identical (except for slot 8 in an XT, as I mentioned). How could an add-in board possibly *know* which slot it was in? I can imagine that some clones might be different. However, having different specs for the different slots would make it less compatible (and less of a clone). On an IBM machine, or a true clone, an add-in board will function the same no matter what slot it is installed in.

ibm.pc/clones #280, from cdanderson, Sat Sep 13 15:18:41 1986. A comment to message 279.

I seem to recall that a Qubie hard disk controller didn't work until I put it next to the floppy controller and "before" the AST SixPak - but maybe I'm remembering Apple days, where order could definitely be a problem.

ibm.pc/clones #339, from hans (Henry Battjer), Fri Oct 3 18:29:48 1986. A comment to message 279.

How about an AT? I was told to put my IBM EGA in slot 1 and only slot 1. Why do you suppose...?

ibm.pc/clones #281, from barryn, Sat Sep 13 15:22:44 1986. A comment to message 280.

Maybe the cables to the disk weren't long enough to put it in a different slot?

ibm.pc/clones #282, from dondumitru (Donald Dumitru), Sat Sep 13 15:36:38 1986. A comment to message 281.

IBM PC and Compatibles

The IBM PC section features two discussions concerning IBM PC clones. In the first, there is a question of power supply and slot-sensitive boards. In the second, hardware interrupts are a problem on a Compaq. The final excerpt discusses a method of scrolling text in specific regions of the screen.



The Atari 1040ST

Dave Menconi

*This system is
an excellent value with only
a few faults*

The Atari 1040ST, like the 520ST, has a powerful 68000 microprocessor, high-resolution color or monochrome graphics, and the TOS desktop for easy handling of programs and files. The 1040ST also has twice the memory (1024K bytes rather than 512K), a 3½-inch floppy disk drive and a power supply that are built in, and the TOS desktop in ROM rather than loaded from disk. [Editor's note: See the product preview of the 1040ST by Phillip Robinson and Jon R. Edwards in the March 1986 BYTE for more introductory information.]

The 1040ST does not, as Atari earlier stated it would, come with an RF modulator (a device that would allow you to use the 1040ST with a standard television set) or a graphics coprocessor (a so-called blitter chip). For color graphics you will need the color monitor, for a total system cost of \$1199.99. The monochrome 1040ST system costs \$999.99.

On the Outside

The 1040ST has three screen resolutions. Low resolution requires a color monitor, allows 16 colors (which you can select from a palette of 512 colors), and has 320 by 200 pixels. Medium resolution also requires a color monitor, allows 4 colors, and has 640 by 200 pixels. High resolution requires a monochrome monitor and has 640 by 400 pixels. There is no overlap between the monitors and the resolutions—the monochrome monitor can't do low or medium resolution, and the color monitor can't do high resolution. Furthermore, if you switch monitors while the system is on, the 1040ST does a warm restart, just as if you had pressed the reset button. Even switching between low and medium resolution has its problems, which I'll discuss later.



The 1040ST keyboard is somewhat spongier than most keyboards with which I am familiar, but I had little trouble adjusting. The keyboard is complete, including a numeric keypad, a set of cursor-control keys, Help and Undo keys, 10 function keys, an Esc key, and a Control key. The layout of the keyboard is quite convenient, especially the cursor-control keys, the Help and Undo keys, and the extra-large Return and Backspace keys. The designers of the 1040ST keyboard, while keeping user-friendliness in mind, also accommodated the more experienced users.

Among the benefits of the full keyboard are the special key combinations that perform useful functions. For example, pressing the Alternate key and the cursor keys allows you to move the cursor around the screen without using the mouse, and

pressing the Alternate key and the Insert key has the same effect as pressing the mouse button. This feature lets you use the cursor-control keys even when the program is not designed for that.

The desktop does not take full advantage of several keyboard features. For example, it does not use the function keys, the Help key, or the Undo key. Similarly, the mouse has two buttons, but the desktop uses only the left one. This does, however, leave these unused features available for use by programmers; if the desktop had used them, designers would be stuck using them in the same way or else being inconsistent.

The 1040ST's 720K-byte double-density drive can read, write, and format single-sided and double-sided disks. Surprisingly, all the double-sided modes are slightly slower than their single-sided counterparts.

When the built-in drive turns on, the external drive also turns on, and vice versa. Also, for some reason, my external single-sided drive turned on for a second about once a minute even when the computer was off. Since this doesn't happen when the drive is connected to the 520ST or is disconnected entirely, it must be caused by the 1040ST.

The 1040ST's built-in power supply causes the top of the computer to get a little warm, but the chips inside seem adequately cooled. I left the system on for days at a time with no problems.

Under the Hood

Inside the case, the 1040ST is completely shielded to prevent RF interference.

continued

Dave Menconi (5333 Betsy Ross Dr., Santa Clara, CA 95052) is a software engineer for Computer Resources Inc.

Atari 1040ST

Company

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Size

18½ by 11½ by 2¾ inches

Components

Processor: Motorola 68000 with an 8-MHz clock

Memory: 1 megabyte of dynamic RAM; 192K-byte TOS in ROM, not including optional desk accessories

Mass storage: Internal 720K-byte double-sided, double-density 3½-inch drive; system supports a maximum of two floppy disk drives

Display: 12-inch monochrome or color monitor; three modes: 640- by 400-pixel monochrome, 320- by 200-pixel with 16 colors, and 640- by 200-pixel with 4 colors

Keyboard: 94-key IBM Selectric-style QWERTY keyboard with numeric keypad, cursor controls, and rhomboid function keys

Sound: Three independent sound channels from 30 Hz to 125 Hz

I/O interfaces: MIDI-in and MIDI-out ports
Centronics parallel printer port (supports Epson-compatible printers)

RS-232C serial port

Floppy disk port

Hard disk port (10-megabit-per-second DMA transfer rate)

128K-byte ROM cartridge

Ports for mouse and joystick or two joysticks

Software

Atari Logo, Atari ST BASIC, 1st Word word processor; NEOchrome graphics editor

Options

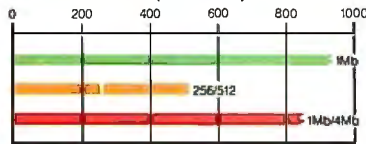
SF354 single-sided drive: \$199.99
SF314 double-sided drive: \$299.95

Price

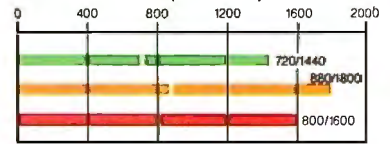
Monochrome system: \$999.99
Color system: \$1199.99

SYSTEM FEATURES

MEMORY SIZE (K BYTES)

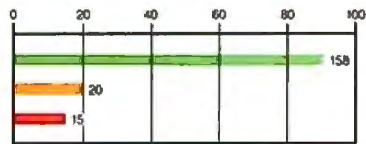


DISK STORAGE (K BYTES)



DISK ACCESS IN BASIC (IN SECONDS)

WRITE

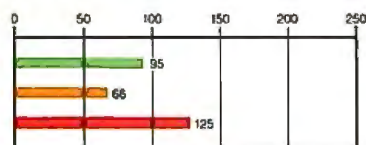


READ

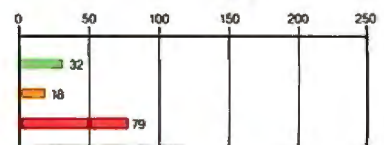


BASIC PERFORMANCE (IN SECONDS)

SIEVE

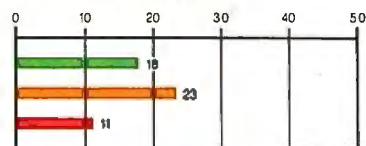


CALCULATIONS

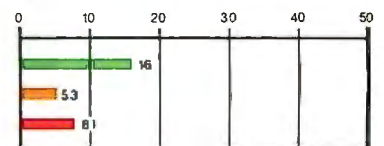


SYSTEM UTILITIES (IN SECONDS)

40K FORMAT/DISK COPY

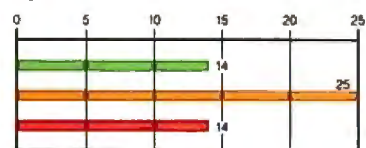


40K FILE COPY

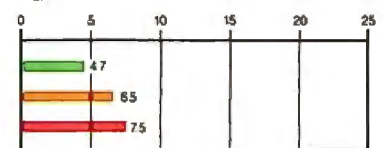


SPREADSHEET (IN SECONDS)

LOAD



RECALCULATE



■ ATARI 1040ST ■ AMIGA ■ MAC PLUS

The Memory Size graph shows the standard and optional memory available for the computers under comparison. The Disk Storage graph shows the highest capacity for a single floppy disk drive and the maximum standard capacity for each system. The graphs for Disk Access in BASIC show how long it takes to write and then read a 64K-byte sequential text file to a blank floppy disk. (For the program listings, see BYTE's *Inside the IBM PCs*, Fall 1985, page 195.) The Sieve graph shows how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. The Calculations graph shows how long it takes to do 10,000 multiplication and 10,000 division operations using single-precision numbers. The System

Utilities graphs show how long it takes to format and copy a 40K-byte file using the system utilities. The Spreadsheet graph shows how long it takes to load and recalculate a 25- by 25-cell spreadsheet in which each cell equals 1.001 times the cell to its left. The Atari 1040ST tests were performed using TOS (in ROM), Atari ST BASIC, and Acalc spreadsheet. The Amiga tests were performed using the Workbench, Amiga BASIC, and the Lattice Unicalc spreadsheet. (Amiga BASIC requires a CLEAR ,30000, 30000 command for the Sieve to run.) The Macintosh Plus tests were performed using the Macintosh System and Finder, Microsoft BASIC, and Microsoft's Multiplan.

The power supply and the built-in disk drive are on separate boards that sit atop the main motherboard. The designers put the ROM chips under the power supply board where they can be easily upgraded. Going in deeper than that is a nuisance because of the shield that covers most of the motherboard.

Under the shield are the same parts that the 520ST has, but they are rearranged on a two-inch longer (from front to back) board to make room for another 16 RAM chips and the other components that are built in. The mouse and joystick plug into the keyboard through a hole in the bottom of the case, which makes the mouse harder to take off and replace than that on the 520ST. Despite early plans for an RF modulator, the 1040ST has only a blank space on the board where the modulator belongs.

TOS

The 1040ST's operating system (TOS) desktop lets you run programs, copy files, format disks, and perform all the other essential tasks of using a computer by clicking, dragging, and double-clicking icons with the mouse.

Until just before the release of the 1040ST, TOS was on disk and you had to load it into the system (a process that took half a minute or more) before you could do anything with the machine. Now the entire operating system is in ROM, allowing the computer to boot in 5 seconds (more if there are desk accessories on your initial program disk) and freeing up 200K bytes of RAM for your programs' use.

The desktop allows you to manipulate documents (data files), applications (programs), and folders (directories). Each folder is, in effect, like a separate subdisk drive. Thus, if the folder MAILST (for your mailing list) on drive A is open, you cannot access any of the other files on drive A. This lets you break up the files into separate directories. Dealing with just the MAILST files is easier than sorting through all the files on the disk.

Folders are especially useful on a hard disk. Within each segment, the folders break up the files into general categories. Within each folder, subfolders break up the files into smaller categories until the total number of items in a folder is manageable. This organization is one of the major reasons for buying a hard disk.

You can nest folders within folders up to eight deep, although I have never seen directories nested more than six deep, even on a minicomputer. You are limited to 40 folders on a floppy disk. Unfortunately, the system does not tell you when you have exceeded the 40-folder limit. At some point after you exceed the limit,

strange things may start to happen to your disk—you may be unable to delete some files, the system may reset when you try to get information about the disk, or some other nasty quirk may develop. In practice, however, this is not much of a problem because you are unlikely to want more than 40 folders on a single floppy disk.

Another quirk is that copying a file to itself damages the directory of the disk. This can happen if you are copying files and you accidentally let go of the mouse button in the same window. The desktop will warn you about the conflict, but if you press Return or click on the OK icon, it will go ahead and possibly ruin the disk. Once again, this is not something that will happen often, but if it happens, the consequences are dire.

Another quirk occurs if you use programs that are in different screen resolutions. Once the system is initialized, you cannot change the resolution. This means that if an application is designed to run in medium-resolution mode and you enter it in low resolution, the application can't correct the problem and switch modes—the best it can do is to give you a message that says, "Please switch to medium resolution," and terminate.

TOS handles this to some degree by remembering the resolution you were in the last time you saved your desktop and initializing the system to that resolution. The only problem with this is that when you are in high resolution using a monochrome monitor and switch to a color monitor, the system switches to low resolution. The difference between low and high resolutions is great enough that they are likely to look very different on your screen, and any applications you run are going to be different, too.

The routines that make the desktop menus, windows, icons, and dialog boxes are easily accessible to programmers. These features can greatly enhance an application's ease of use by putting control in the hands of the user.

TOS vs. the Macintosh Finder

The TOS desktop is very similar to the Finder in the Apple Macintosh but with a few significant differences.

The Macintosh keeps track of what disk is in each drive and keeps strict control over when a disk can be ejected, while the 1040ST has ejection buttons. When you change disks on the 1040ST, you must press the Esc key to update the screen.

The Macintosh lets you move icons around the window at will and view the files in one window as icons while viewing those in another as text. On the 1040ST the icons are arranged for you, and all windows have to be either textual or iconic.

On the 1040ST, the menus pop down whenever the pointer passes over them, and the menu stays down until you click the mouse either in the menu or elsewhere on the screen. In comparison, on the Macintosh you must click on a menu for it to come down.

Another difference is the pause that the 1040ST requires between when you click on something and when you are able to move it. On the Macintosh, you can click on an icon and start dragging immediately; under TOS, you must pause for an instant before moving the mouse.

Taken singly, these differences aren't terribly significant. But as a whole, they show a trend: The Macintosh Finder is intended to be a perfect user interface, while the TOS desktop is designed to be a simple, easy-to-use workhorse.

Software

Unfortunately, relatively little software is available that really makes use of the windows, menus, and icons so characteristic of TOS. Each developer creates his or her own user interface from scratch, and every program will come up with a different way of handling similar tasks.

For example, 1st Word, a TOS-based word processor that comes with the 1040ST, provides two ways for exiting a document: QUIT, which throws away your work (after warning you), and SAVE, which closes your document after saving it. You cannot save the document without closing it. Power failures do happen, and most computer users learn to save their work often, a task made very inconvenient by this program.

Aside from this problem, 1st Word has a full range of features. It supports a large number of printers, several font styles (including bold, italic, and underlined), cutting and pasting, and "what-you-see-is-what-you-get" screen editing.

Unfortunately, the latter feature makes the program somewhat slow. When I conducted the word processor benchmark tests on two hard disks (see the text box "The Atari SH204 and SupraDrive Hard Disk Drives" on page 234), 1st Word was slower than ST Writer (an old-style word processor that uses embedded control characters).

The 1040ST also comes with Atari ST BASIC, Atari Logo, and NEOchrome, a paint program. Atari ST BASIC has some nice features. It starts up with four windows: one for editing, one for listing programs, one for output to the screen, and one for commands. Each of these windows can be resized, moved, activated, or closed by using the mouse. This is a good deal more flexible than the approach taken by other BASICs.

continued

The Atari SH204 and SupraDrive Hard Disk Drives

The extra power and memory of the Atari 1040ST makes the addition of a hard disk drive appropriate. I used the 1040ST that I reviewed with the Atari SH204 hard disk and the SupraDrive from Supra Corporation.

Both the SH204 and the SupraDrive are 20-megabyte drives. Unlike Supra, which makes a 30-megabyte drive, the largest drive Atari makes is the SH204 (it also makes a 10-megabyte drive). But Atari has made provisions for having multiple drives on one system. The drives can be numbered from 0 to 7, so theoretically you can have up to 1600 megabytes of storage on-line at one time. However, the manual is not clear about how you hook two hard disks up, since both the computer and the hard disk have only one plug. In spite of that, the SH204 manual is better than the SupraDrive's, but the latter still has all the information you need.

Neither the SH204 nor the SupraDrive can have partitions larger than 16 megabytes, so the 20-megabyte disk drives must be segmented into two or more logical drives, none of which can hold more than 16 megabytes.

The SupraDrive is 11 inches long and 5½ inches wide, but it needs extra space all the way around to provide for cooling. An annoying trait of the drive is its noise. While the drive is on, it produces a persistent low hum that can be heard for some distance.

The SH204 is 15 inches long and about 8 inches wide—much larger than the SupraDrive. It is also considerably noisier—you can't hear the SupraDrive if the Atari drive is on.

Although the 1040ST's ROMs allow for only 40 folders on a disk, the SupraDrive's boot software installs a patch that allows up to 70 folders. Care should be taken, however, not to exceed this 70-folder limit. If you do exceed it, the disk directory is likely to become very sick and ruin part or all of the hard disk. However, the documentation gives no warning of this danger.

I found both hard disk drives to be well worth their price tags. The increased access speed and expanded storage augment the 1040ST's power considerably. [Editor's note: For the benchmark results, see table A.]

Atari SH204

Type

20-megabyte hard disk

Company

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Size

15 by 8 by 4 inches; 9 pounds

Features

Chaining of multiple drives

Software

Boot software; format and utilities software

Options

10-megabyte hard disk (SH104) also available

Documentation

User's manual

Price

\$799.95

SupraDrive

Type

20-megabyte hard disk

Company

Supra Corp.
1133 Commercial Way
Albany, OR 97321
(503) 967-9075

Size

11 by 5½ by 3¾ inches; 5 pounds

Features

5¼-inch drive with Rodime controller

Software

Boot software; format and utilities software

Options

Also available in 30-, 45-, and 60-megabyte sizes

Documentation

User's manual

Price

\$799

Table A: Comparison of the BYTE benchmarks on the Atari SH204 and SupraDrive 20-megabyte hard disk drives. All times are in seconds.

	Atari SH204	SupraDrive
Write 64K-byte file (BASIC)	82.00	83.30
Read 64K-byte file (BASIC)	177.00	172.70
Copy 40K-byte file	2.63	3.20
Load spreadsheet (ACalc)	8.89	9.99
Document load		
ST Writer	5.86	5.94
1st Word	9.33	9.88
Document save		
ST Writer	4.67	2.03
1st Word	10.11	7.99

However, ST BASIC's I/O capabilities are limited. As the benchmarks show (see page 232), reading and writing from BASIC, even with a hard disk (see times at left), is very slow.

The Atari Logo program is a simple-looking dialect of LISP and is powerful for all its apparent simplicity. The major feature of Atari Logo is its use of turtle graphics; graphics commands are given from the cursor's point of view, thus greatly simplifying programming.

NEOchrome is a beautiful graphics editor. It is almost worth getting a color monitor just to see the pictures that come with this program. NEOchrome doesn't work with a monochrome monitor. An especially clever feature of the program is the ability to roll selected colors through the color registers, thus giving still pictures the illusion of motion.

1040ST vs. 520ST?

Why buy an Atari 1040ST instead of a 520ST? To begin with, the 1040ST has fewer power cords. A comparable 520ST has two power supply boxes (one for the computer and one for the disk drive) and three power cords (one for each power supply and one for the monitor). The 1040ST has no power boxes and only two

power cords. This may not seem like much, but all those cords become tangled very easily, and any decrease helps.

The major reason to get a 1040ST, however, is the extra memory. While the 520ST can, in theory, handle as much memory as a 1040ST (both use the same memory management chip, which can handle 4 megabytes of RAM), the board in the 520ST has no space to hold the extra chips. A number of schemes have been devised for adding chips to the 520ST, either to the top of the existing chips or to the bottom of the board. Unfortunately, soldering that number of chips onto a board with such close tolerances is apparently extremely difficult—even experts have ruined computers. Lately, upgrades that consist of a board that plugs into existing sockets have become available. These look promising, but they are still too new to be sure of. If you want a megabyte of memory in your computer, you are definitely better off buying a 1040ST than trying to add chips to a 520ST.

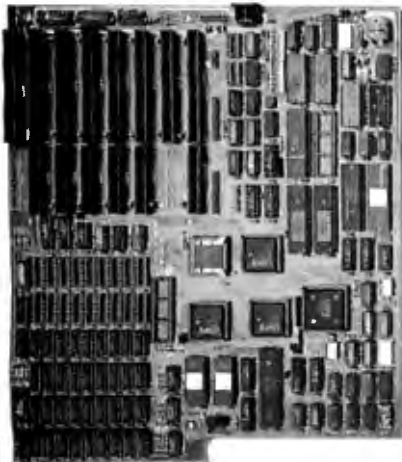
What would you do with a megabyte of memory if you had it? The simplest use for a large piece of memory is a RAM disk, which makes some of your RAM act like a very fast disk drive and makes almost any program run faster.

Beyond that, most common applications such as word processors, spreadsheets, and database managers should be able to make use of all that extra memory directly, even without the use of a RAM disk. A smart database manager, for instance, would allow you to edit and sort records in memory and would be much faster for databases that fit completely in RAM. A megabyte of memory would also allow you to put a very large database on your computer and manipulate it solely in memory and very rapidly.

Finally, you can do some powerful graphics and voice-synthesis tricks with a megabyte of RAM. For instance, an animation program could buffer the frames that are coming up and thus achieve very good, fast animation.

Conclusion

The Atari 1040ST is an excellent value with just a few problems that mar an otherwise ideal product. These include the lack of an RF modulator that would allow you to use it with a television set, the possibility of damaging disks if you exceed the desktop limit on folders or try to copy a file to itself, and a shortage of software that makes use of the desktop interface. ■



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A Confederation of Hackers

Jerry Pournelle

Jerry goes back to camp and compares notes with classic hackers

Last weekend I went to Hackers 2.0, the second edition of the Hackers' Conference. The first one was held in 1984 up near the Golden Gate; we had this one in a retreat camp not far from Saratoga, which is a town at the far edge of Silicon Valley. It turned out to be an inspiring location among redwood forests, and to add to the mood the weather was magnificent.

Most of the giants of the hacker community were there: so many that it's impossible to name them all, and insulting to name a few as representative. There were hackers from every era, from the early days at MIT and Stanford to newcomers who work with Apples, PClones, the Atari ST, and the Amiga.

Some incidents: the Long March Beer Run. A companion and I set out for Saratoga (four miles away) for beer. There was an overturned bus on the two-lane highway, making it impossible for us to get past; so, we thought, we'll go the other way, uphill. Twenty-two very twisty miles and 45 minutes later we ended up on Page Mill Road in Palo Alto.

Bill Atkinson and Steve Capps, authors of QuickDraw, came up to me in the dinner line. "Do you think the Macintosh will survive?" they demanded, thus continuing a conversation started two years ago at the first Hackers' Conference.

"With a new keyboard, more memory, faster disk access, and a way to communicate with other machines—why shouldn't it?" was my only possible reply.

They also explained why they used the single-button mouse. "If it has more than one button, people look at the mouse rather than the screen," Atkinson said. "We didn't want them to look at the mouse. Besides, there's nothing you can do with several buttons you can't do with a single-button mouse if the software's designed right." That makes so much sense I want to think about it awhile.

On the first night, someone short-sheeted my bed. On the second, they'd wired a Radio Shack buzzer to scream at

me when I, full of good cheer and Philippe Kahn's donated champagne (he paid for the masquerade party), tried to go to bed. Fortunately, I had brought my great double-bladed axe—at the masquerade it was my double-sided double-density hacker's tool—and it was no great problem to disconnect the buzzer.

I also met the original Amiga designers and saw what may be the best educational tools ever invented, namely, a series of animations, narrations, and illustrations that do a better job of teaching physics than anything I've ever seen before. This was developed largely at JPL (NASA's Jet Propulsion Laboratory) and has been on PBS. If I'd had something like this to study in high school and early college, I'd know a lot more about physics now. The computer revolution affects more than just computing.

There were the usual conferences and discussions of copy protection. We're all agreed that information piracy is a growing problem, and there appears to be no ready solution for it. I admit to being a bit scared, since I make my living from intellectual property, and that's becoming hard to impossible to protect. In a very real sense, we're all going to have to depend on ethics—and the last I heard, that isn't even being taught in the schools any longer.

It was an exhausting conference, with all the usual discussions of the future of computing and hacking and society and how hackers can change the world. Impossible to summarize, but more than worthwhile. A good conference. I'll be happy to go to the next one.

More Atari ST

A number of people brought machines to the conference. One of the most

popular was an Atari ST brought by Alex Leavens. Alex, incidentally, is working with Mrs. Roberta Pournelle to program her reading instruction program for the ST. He's done about half of it, and I must say it really

looks great. Roberta can hardly wait until he finishes, and I must confess mild anxiety myself.

The program incorporates most of what she learned in more than 20 years of teaching reading to illiterates of every age and with every disability. We have every reason to believe it will work: with luck and skill that program could change the world.

The first version requires that someone who can read work with someone who can't: the lessons come up on the screen, the "instructor" pronounces the words in the lesson, and the student follows along. The computer keeps track of lessons and progress and when the student gets things right puts on a light or a music show as a reward.

The next version will, we hope, just about eliminate the instructor. The Atari ST has good enough speech-synthesis hardware to do that. Alas, the speech-synthesis *software* that comes with the ST isn't so hot, and I don't know of anyone with plans to rewrite it. Maybe, though, by the time the first version of the reading instruction program is out something will be done.

The most popular Atari ST software at the conference was a game, StarGlider, which I confess is pretty addicting. It comes with a science fiction novella that's a little overwritten in places, but it reads well enough—and sure sets things up for the game. I've had a bit of trouble learning to use a mouse to control a fighter

continued

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future.

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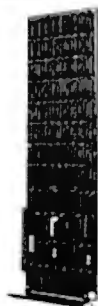
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CHAOS MANOR

plane—I'd have thought a joystick would be better—but people more expert with arcade games than I am say they actually begin to prefer the mouse when they get used to it. One thing I did learn from StarGlider was why the U.S. Navy prefers two-seater fighter planes. It's hard to fly that thin and still go kill targets, especially if you have to guide missiles until they lock on. Anyway, if you like arcade games, you'll love this one.

Incidentally, StarGlider was developed with HiSoft's DevpacST (available from Apex Resources), an assembly language development system Bruce Webster recommends highly (see the November 1986 BYTE). I confess that I've never written a program in 68000 assembly language. Since my publishers are seriously discussing putting out contracts on me if I don't turn in some novels, it's not likely that I will for a while. Those who do write assembly language programs for the ST seem to like HiSoft's package a lot.

Atari had also finally released the ST version of the old 8-bit Star Raiders. This is a pure shoot-'em-up with only the most rudimentary strategic decisions, but it has absolutely gorgeous graphics. I notice on BIX that even those who hate the program seem to spend a lot of time playing it.

Finally, I have the Epyx version of Rogue for the Atari ST. It has a number of refinements: great graphics, an on-screen inventory visible at all times, graphic representation of strength and hit points, and a whole bunch of other stuff. It's estimated that since Michael Toy first wrote Rogue for UNIX systems the game has cost more than a billion dollars in machine and programmer time wasted. If you like Rogue for any machine, you'll love it for the Atari ST.

Flash

I don't often play Star Raiders, or Rogue, or StarGlider for that matter, mainly because Mrs. Pournelle is using the Atari ST for BIXing. Like most recent converts to BIX she's become an addict, and it's nearly impossible to get her away from the silly machine.

What she's using is a Volks VM 520 modem from Anchor Automation connected to the Atari 1040ST. This is a slim little thing with only one control and no blinking lights, sort of the bare essence of a modem, and it works fine with the Atari ST. The communications software is Flash from Antic Software.

Flash is one of those products I call infuriatingly excellent. Excellent in that it does the job and has just a lot of desirable features. Among other things, it automatically captures everything you've sent and received (at least as much as there's memory for, which in a 1040ST is a lot);

a click on the right-hand mouse button and you can go back and review whatever you got off BIX, and if you've got a printer hooked up, you can print all or part of it, too.

Another Flash feature is a rather nice little full-screen editor you can use to compose messages and send them. Actually, the editor is part of the capture buffer: you can compose a message in there, mark it, and send it—Flash sends marked blocks of text. Naturally, you can do the same thing with text you've already received, meaning that it's a lot easier to edit BIX messages in Flash than it is to use the primitive BIX line editor.

Flash can upload and download using Ward Christensen's XMODEM protocols. It has a translation table, meaning that as you send or capture text you can change anything to anything else: very useful if you have a computer with weird internal symbols, such as an Atari XE, which uses ASCII character 155 instead of a carriage return—the translation table can change incoming CRs to the 155 character and vice versa. Flash has a script capability: you can set up a series of commands and events and make them all happen when you log in.

In other words, Flash has plenty of nifty features, so why do I call it infuriating? As usual, it's the documents. If you want to use Flash, you'd better be prepared to read the entire 50-page book not once, but at least twice: unless you're more familiar with these things than I am, you won't understand on the first pass through. And since there's neither index nor analytical table of contents, you've got to read it all to find out what features are available, much less how to use them.

Flash doesn't have terminal emulation (or if it does, I haven't found that out) and lacks a few of the other features of really advanced communications programs; the documents aren't at all clear and in some cases are downright misleading on the more advanced features; but the bottom line is that it took no more than five minutes to set up the Atari ST with the Volks modem and Flash, and Roberta has had no trouble using it. The price is good, too. Recommended, provided you're willing to read the documents twice.

Monochrome

I've always had the Atari ST monochrome monitor, but for one reason or another I never used it; but when Alex Leavens came to visit he brought a copy of Magic Sac, the cartridge that plugs into the side of your Atari 1040ST and lets it run Macintosh programs. Magic Sac requires monochrome, so I fished the monitor out of the back room and plugged it in.

continued

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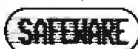
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CHAOS MANOR

Incidentally, if you have both color and monochrome for the Atari ST, you want to be careful how you change from one to the other. The safest way, of course, is to turn the computer off while making the switch. You can also disconnect one monitor, reboot while no monitor is connected, and plug in the other one. The reason for this is that the Atari checks on boot-up to see whether you're using monochrome or color, and it sends out voltages sufficient to ruin one monitor if it thinks it's sending to the other.

I understand there's a company making a cable switch device just for the Atari; it will automatically reset the machine if you throw the switch to change from one monitor to the other. I sure wish I had one.

Anyway, we hooked up the monochrome monitor. We in this context are Alex Leavens and I. Alex is the moderator of a couple of Atari-related conferences on BIX, and he knows more about the Atari ST than any Atari employee I ever met. When we got the monochrome display hooked up, I could see why everyone is impressed with it; but, alas, it was too small for me to see very well.

No problem, said Alex; whereupon he proceeded to open up the monitor and tweak the vertical and horizontal amplification until the image filled the entire screen. The result is letters about 10 percent larger, which is to say large enough for me to see. You do pay a penalty, in that screen images are not precisely square any longer. You have to be careful with CAD stuff. For me, though, that larger image far outweighs the shape distortion, which is really so mild I have to look close to notice it.

A lot of Atari ST software will run on both color and monochrome. That includes games like StarGlider, and indeed many StarGlider addicts prefer the monochrome version because it's supposed to give more precise control. Alas, Time Bandit and Star Raiders require color.

The Atari ST with monochrome looks as good as the Macintosh to me, and certainly the image is larger. Quite impressive, especially considering what it costs. More and more Mac software gets ported from Macintosh to Atari ST with Magic Sac; ST owners who don't have monochrome and Magic Sac should seriously consider getting both.

Okidata Okimate 20

This is pretty close to a printer for all seasons. The Okimate 20 is a small—I mean really small, about the size of an Atari ST—dot-matrix printer that can take any of a number of “plug and print” modules to adapt it to your particular com-

puter. Mine came with a module for the Atari ST; but Okidata is sending me modules to let me use it on an Amiga, IBM PC, and Apple IIe.

Each module comes with an instruction book, programs, and cable, all—including instructions—keyed to the particular computer you'll be using it with.

We had the Okimate 20 hooked up to the Atari ST in about 20 minutes. Fifteen were spent getting the paper into the machine. As with a lot of those small dot-matrix jobs, feeding in the paper is a black art. I suppose it gets easier with practice. Meanwhile, I keep eyeing the paper supply, hoping it will last long enough that my blood pressure will be lower when I have to put in new paper. Of course, I had even worse problems with the Epson printer. The only small printer I know that's easy to get paper into is the one from MPI.

Aside from getting the paper in, the Okimate 20 works great. The instructions are incredibly clear, with good illustrations. Some real editorial work went into producing this instruction book. (I have only the one for the Atari ST, but since the printer has been out longer than that computer, I'll assume they've done a good job with the other machines, too.)

Once you get the Okimate 20 hooked up, you're in for a treat. It's quiet. Not as quiet as a laser printer—what is?—but quiet enough that you can be in the same room with it and not go mad.

It also does great print quality in document mode. I often get letters from readers asking if editors will read manuscripts printed in dot matrix. I generally say it depends on the manuscript: editors will tackle anything if it's good enough, but the harder it is to read, the better the submission had better be. With the Okimate 20 you needn't worry; I, at least, can't tell its document mode from a Diablo daisy-wheel printer's output. The Okimate has a Courier—more or less—type font, and the letters are black and filled in. The lowercase descenders like j and g really descend below the line, and, in a word, the output is indistinguishable from impact printers.

It does this by a thermal-transfer process. That doesn't mean you need “thermal paper,” although in fact the Okimate will print on thermal paper provided you remove the ribbon. (You can even use rolls of thermal paper if you want to.) Thermal transfer means that the 24 dot elements are heated and melt wax off the Okidata ribbon onto the paper. It stands to reason then that the paper has to be smooth, meaning that you can't use high rag-content bond. On the other hand, copier paper works fine, and so does the “computer paper”

continued

Inquiry 54 →

amiga/amiga68000 #92, from ksalmon, Mon Oct 13 01:41:47 1986. A comment to message 91.

In my case, that was just having been there before, and spending some time staring at the Include files. So, I know from practical experience that it works. Ken

amiga/amiga68000 #93, from cheath, Mon Oct 13 01:47:36 1986. A comment to message 92.

I stared, too, and didn't see anything obvious. Guess I'm not familiar with the structure definitions in Metacomco format - are they documented anywhere? Also, is there any relationship between the structure names in the ".h" files and the offsets in ".i" files?

amiga/amiga68000 #94, from jdow, Mon Oct 13 01:51:39 1986. A comment to message 93.

Yes, indeedy. Count out the bytes offset from beginning of the structure. They SHOULD be the same. I remember trying it some longish time ago last year just after getting the assembler and C compiler and trying to fathom fonts. <^_>

amiga/amiga68000 #95, from ksalmon, Mon Oct 13 01:56:14 1986. A comment to message 93.

I figured it out a while ago by just sitting down with the macro definitions in exec/types.i and seeing how they were used in other Include files. Those macros aren't commented, but they are pretty simple. Most of the field names with .i structures have the same names as the .h fields, with a 3-character prefix (structure initials and _). But there's a lot of inconsistency, and the cases don't always match. It generally means you have to study each one individually to get the right name. I usually use a hard-copy listing of the .h version side by side with the .i version in RKM 1 & 2 (boy, I sure wish they had left all the Include files together like in the old RKM, instead of splitting across volumes). Ken

amiga/amiga68000 #96, from ksalmon, Mon Oct 13 01:58:28 1986. A comment to message 94.

I started out counting byte offsets just to assure myself everything was in order. Then I realized it's a *lot* simpler just to compare the .h and .i versions side by side. Things fall into place much quicker that way. Ken

amiga/amiga68000 #98, from cheath, Mon Oct 13 02:03:39 1986. A comment to message 95.

I'd figured out the xx_ stuff, but not the substructure offsets; the names for substructures don't seem to have any relation to the ".h" equivalents. Am I missing something?

amiga/amiga68000 #99, from jdow, Mon Oct 13 02:08:39 1986. A comment to message 98.

They seemed to with the fonts stuff. It took some serious digging 'til I got the flavor of how the cumulative offsets worked in there. Then I seem to have clicked a translator in my head for the assembly STRUCTURE declarations comparing to C "struct" declarations. Once that worked, it was obvious. Now, the reason I am a wizardess and not a guruess is I can work the magic but not adequately explain it. <SIGH>

Remember to note exactly what size an object in a C language declaration really is. Many times, you find a structure included in full rather than as a pointer in a C declaration. Then, the offsets simply add. Otherwise, if only a pointer is included, the offset simply adds four bytes. I seem to remember that there was a different name for assembly pointers, sizes, and actual objects. Had to do with the prefix, I think. --- so long ago. I'm getting old and forgetting stuff only a year old already! <^_>

amiga/amiga68000 #101, from ksalmon, Mon Oct 13 02:22:15 1986. A comment to message 99.

It really turns out to be quite simple:

A STRUCTURE macro defines a new structure, just like a struct in C; if the second parameter is non-zero, it defines the size of what would be the first embedded substructure. The symbol SOFFSET is used to keep a running offset for locations within the structure.

A STRUCT macro defines an occurrence of some other structure, as a substructure to the current STRUCTURE. The first argument is equated to the substructure name, then SOFFSET is advanced by the amount of the second argument (mostly, this will be xx_SIZEOF, but sometimes they fool you and use lowercase).

BYTE, UBYTE, WORD, UWORD, APTR, BPTR, and the rest simply equate the first argument (actually the only one) as a label, to the current SOFFSET, then advance it by the appropriate number of bytes.

LABEL is generally used at the end of a STRUCTURE list, to assign a label to the current value of SOFFSET. That label is the one used in other STRUCT occurrences, to "reserve space" for that many bytes in the SOFFSET counter.

It really isn't necessary to add up the offsets in your head. Just use those symbols and let the assembler worry about it. The key thing is to remember that a STRUCT is just like a subordinate struct in C. I understand the complaint that there is not always a one-to-one match with the actual names used in the C header files. That's why I recommend a side-by-side comparison. Works every time or your money cheerfully refunded. Ken

ATARI ST

The questions in the Atari section this month are all solved using the tools within C. In the first, the problem is C; or more specifically, the way C handles (or doesn't handle) data structures. In the second, the details of high-speed, low-level control of the MIDI port are discussed.

STRUCTURES IN C

atari.st/c.language #384, from cmarriott (Chris Marriott), Fri Oct 24 07:39:11 1986.

There seems to be a bug in code generation with the Megamax C compiler. Recently, I've written a routine to print disk directories, which uses the following structure for a disk transfer address block:

```
struct {
    char system[20];
    unsigned char attribute;
    unsigned int time;
    unsigned int date;
    long size;
    char name[13];
} dta;
```

The problem is that all the information is getting passed into the structure OK, *except* that references to the characters at the start of the structure are out by one, for example, to get at the attribute byte, I cannot use dta.attribute, I have to say dta.system[21], which *should* refer to the first byte of the time field. The time and all later fields are OK, though, so it seems like Megamax is referencing all the character offsets as one too great.

Can anybody see if I'm missing something here, because this looks like a bug to me. +++ Chris M +++

atari.st/c.language #385, from comeau (Greg Comeau), Fri Oct 24 08:30:16 1986. A comment to message 384.

continued

Try changing "unsigned char" to just plain "char". Of course, this may require that you change some of your logic also. Or are you saying that the system also starts at system[1] and not system[0]?

atari.st/c.language #386, from sprung (Ron Sprunger), Fri Oct 24 12:06:37 1986. A comment to message 384.

Your system variable is one too short - use bytes 0 through 20.

atari.st/c.language #387, from mmallett (Mark E. Mallett), Fri Oct 24 13:40:48 1986. A comment to message 386.

Right. Just to be more explicit, dta.system[21] accesses TWO past the end of the system element, since declaring system[20] defines the array from 0 to 19. mm-

atari.st/c.language #388, from jim_kent (Jim Kent, Dancing Flame), Fri Oct 24 15:20:27 1986. A comment to message 387.

Also, many compilers will pad structure elements (especially ints) to be on even (WORD) addresses. This isn't a bug but in fact makes the 68000 go faster.

atari.st/c.language #389, from sprung, Fri Oct 24 15:31:43 1986. A comment to message 388.

It may not be a bug, but it sure could foul up some re-mapping that the less-disciplined of us (read sprung) do occasionally.

atari.st/c.language #390, from comeau, Fri Oct 24 22:33:09 1986. A comment to message 388.

Even further... some will align the beginning of the structure itself on a word (or some multiple thereof) boundary.

atari.st/c.language #391, from sprung, Sat Oct 25 02:24:39 1986. A comment to message 390.

That could be interesting if you allocate a bunch of them in sequence and try to access them absolutely as an array.

atari.st/c.language #392, from jim_kent, Sat Oct 25 03:50:20 1986. A comment to message 391.

Oh, but the same compilers will most likely pad the length of the array (the returned value of the sizeof() compile-time function) to be even as well.

atari.st/c.language #393, from heller (Robert Heller), Sat Oct 25 12:58:41 1986. A comment to message 388.

It is also REQUIRED in the 68000 - you can't fetch a word or long from an "odd" address - causes an alignment error trap (exception #3: Address Error). So... malloc and friends on a 68000 system should (had better!) return even addresses, and C compilers generally always give an even number for sizeof (some struct type) and will pad structure elements in structs to make ints and floats come out on even offsets. It is generally considered a compiler bug if the compiler will let you declare something like

```
struct x { char name[33]; int z; } ;
```

and really only reserve 33 bytes for field name. Most proper C compilers will actually pretend that you said

```
struct x { char name[34]; int z; } ;
```

(The same will (should?) happen for Pascal and Modula record types.) Note that this is a sticky portability problem, but only if you need to transfer data packed into binary files (i.e., ARC files - the MS-DOS version does fwrite/fread with an odd-sized struct - the headers in ARC files are 29 bytes! Of course, the (long) ints are byte-swapped, too (low byte first, the 68000 wants high byte first...)). Robert

atari.st/c.language #394, from jim_kent, Sat Oct 25 13:33:12 1986. A comment to message 393.

Actually, I believe the Green Hills compiler will let you start an int on an odd address, and then fetch it a byte at a time. Maybe I'm wrong, I didn't look at the assembly, but there were things I thought would cause an exception #3 in some early Amiga IFF routines that didn't when compiled under Green Hills or Lattice, but certainly did under Aztec.

LOW-LEVEL READING OF SERIAL PORTS

atari.st/c.language #401, from hsoroka (Howard Soroka), Sun Oct 26 02:06:55 1986.

I need to read the MIDI-in port of the ST VERY QUICKLY! The BIOS/XBIOS calls to read and write these ports seem to work OK, but they're extremely slow, or so I think. I say this because my attempts to read and store data dumps from various Yamaha MIDI devices only work if the devices are sending very small dumps (< 255 chars). It seems that, with more information coming in, a buffer is being overrun in the ST, as the BIOS read calls don't empty it out fast enough. This poor little buffer is being blasted with 8K or 9K bytes at maximum speed (31.25 Kbaud is the MIDI rate; pretty snappy).

The solution (I suspect) is to read the ports in an assembly routine called from C (MWC, of course). Why then does the system politely BUS-ERROR every time I try to read from 0xffff04 or 0xffff06 (the MIDI ACIA ports)? Same thing with the other ACIA (at 0xffff00 and 0xffff02). I think it's a bus error anyway (2 cherry bombs, non-fatal). For now, I'd be happy to just read one byte, let alone the whole mess. I know some may think this question belongs in the MIDI department, but it's really a question about ST internals more than MIDI itself.

Here's the code I use (from MWC). I also tried setting the status register to 0x2700, but that made no difference. This code does work consistently with any address between 0x1000 and the top of RAM, but how on earth do you read a device port at a low level? The BIOS appears to do the same kind of thing as I'm trying (according to the Abacus books). Why does it work for the BIOS and not for me? HELP!

```
.shri
.globl atest_ atest_
link    a6, $0x0
clr.l   d0
movea.l 0x8(a6), a0
move.b  0(a0), d0
unlk    a6
rts
```

The variable passed in on the stack is the address we want to read, of course, using a0 to do so. ARRGGGHH. MFFTTSSFFTT... BZZZZTT. BZTZZTZZ. (Sound of programmer imploding, much gore, tears shed, etc.) Beggingly, howard

atari.st/c.language #407, from jim_kent, Sun Oct 26 15:01:09 1986. A comment to message 401.

Looks real simple to me, Howard; you just need to pass the address of your routine to the OS to execute in supervisor state with a Super call. It's in osbind.h somewhere...

atari.st/c.language #408, from jltittsler (Jim Tittsler), Sun Oct 26 16:31:51 1986. A comment to message 401.

The MIDI input is being received by an interrupt service routine and stored in a small circular buffer by the BIOS. If your program cannot take it out of the buffer fast enough to keep it from overflowing, I think

continued

there are a couple of better solutions than directly reading the UART at task time. 1) Increase the size of the buffer. XBIOS call 14 (iorec) returns a pointer to a structure that contains a pointer to the buffer to be used, as well as the size of the buffer (and other things). 2) Write your own interrupt service routine to buffer the bytes at interrupt time. XBIOS call 34 (kdbvbase) gives you a pointer to a structure that includes a pointer to the MIDI input interrupt service routine that will be entered with the MIDI byte in D0.b.

atarl.st/c.language #410, from tjeffries (Tom Jeffries), Tue Oct 28 04:33:42 1986. A comment to message 401.

If I remember correctly, you can change the size and/or location of the MIDI buffer without having to write your own routine with one of the XBIOS routines. If you do want to read the port directly, jim_kent is correct that you need to be in supervisor mode to read those memory locations. Supexec() in the XBIOS is another function to get you in that mode. I'm curious about details of the data loss you are experiencing. I've hit the MIDI-in pretty hard and have still been able to get everything out with Bconstat(). What are you reading, patch data? And do you miss chunks of bytes or a bit here and there?

atarl.st/c.language #411, from hsrorka, Tue Oct 28 12:03:21 1986. A comment to message 410.

Jtittsler suggested a couple things, one of which was manipulating the size and location of the MIDI buffer with XBIOS function 14 (iorec). Jim_kent mentioned the Super() call for reading the port directly from assembly language. You're all correct. All of your (the three of you collectively) suggestions work!

The most robust approach, however, is definitely to change the size of the buffer (why go low-level when it's not necessary?). This worked the first time. I simply declare a large global array of chars in my program and, using iorec(2) to find the address of the MIDI buffer, I replace the contents of that iorec struct with the relevant information of my own. I flush out the "real" MIDI buffer before doing this, although I'm not sure that that's necessary. When I'm through, I replace the old buffer's iorec using a struct assignment, but this requires the Super() call, as the iorec lives in protected memory (I think. Am I right about this, guys?).

This works like a champ, and no assembler required. Many thanks to you folks for your kind help; you've improved the quality of life on Earth.

As for the actual MIDI data, I was trying to store data dumps from a DX-7, RX-11, and QX-7 sequencer. Since all MIDI system-exclusive messages end with EOX (0xf7), my code waits for that character to terminate its read loop. The RX-11, for example, blasts out about 8K bytes at maximum speed when told to dump. The MIDI buffer being circular, all that data just kept overwriting the buffer (which I think is only 128 bytes) so often that the 0xf7 just got lost along with loads of other stuff. In addition to not gathering the correct data, my program would usually hang, because it never found an 0xf7 anywhere. The f7 was probably somewhere in the buffer, but lost between the head and tail pointers, and therefore never recovered. I was losing whole chunks of many bytes, in answer to your question, not merely a bit or two here and there.

Ugh, what a mess. However, all is hunky-dory now. Have you had success using the BIOS/XBIOS calls for large data dumps without changing the buffer? If so, I'd love to know how. Thanks...
howard

atarl.st/c.language #412, from dsmall (David Small), Tue Oct 28 16:47:54 1986. A comment to message 411.

I had to increase the buffer size in the MacCart as well to handle input blocks of 5120 bytes (decimal) coming in at 9600 baud, so I believe that MIDI might drop bytes at 31 Kbaud.

atarl.st/c.language #413, from tjeffries, Wed Oct 29 03:44:48 1986. A comment to message 411.

Howard, I wrote a patch editor for the Casio CZ series (CZ PATCH, published by Dr. T's Music Software) that just grabs the sys ex data as it comes in and sticks in my own buffer area, so I didn't have to rely on the ST's buffer at all. Easier than changing the buffer, but then, I always know how many bytes are coming in. Actually, I've been quite pleased with what I've seen of the XBIOS MIDI calls. I'd sort of expected to have to write my own low-level stuff but Atari's stuff has been robust enough (as long as I didn't rely on the size of their buffer) that I haven't had to. I've had a lot more trouble with different Casios operating/responding at different speeds than I've had with the ST.

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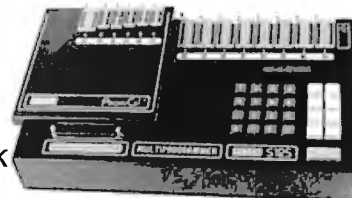
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atarl.st/c.language #418, from jtittsler, Wed Oct 29 22:53:44 1986. A comment to message 413.

The only word of warning about the MIDI OUTPUT routines provided in the standard TOS is that it's done by polling the UART rather than by interrupts. This has the advantage that you can know within a character time when that byte is being sent, and the disadvantage that if the UART is busy outputting the last character, you will wait for it (so, in some applications you might want to check the output status before calling the output function). Just a "user note."

atarl.st/c.language #419, from dsmall, Thu Oct 30 02:49:30 1986. A comment to message 418.

Also, look out for the IPL=7 bug. If you kick up the IPL when data is coming in, you can get into a deadlock situation with the MFP and UART. Essentially, the UART gets 2 chars in the non-services time (while IPL=7). The IPL is then restored. MFP processes first interrupt. However, 2nd character is never "seen" by MFP because the UART holds the IRQ line low (asking for service) -- and the MFP is edge-triggered. This locks your keyboard/mouse, if done to that UART, and should hang the MIDI as well, because it's the same line. Moral: Watch the IPL critical code stuff during I/O.

-- Sadder and wiser, Dave

IBM PC and Compatibles

The threads in the IBM PC section serve to illustrate how discussions flow in BIX. In the first, a question on reentrant code is answered and is promptly followed by a longer discussion on DOS return codes. In the second, a question in the IBM PC conference is ultimately answered in the Telecomm.Tech conference, with pointers showing the connection between the two conferences.

REENTRANCY IN MS-DOS

lhm.pc/programming #546, from damoore (Dave Moore), Mon Oct 13 07:08:25 1986.

I have been trying to write a "HOT KEY" routine that would allow you to reenter a program when a key was struck (as opposed to when it is read by a program/MS-DOS - slightly different). To overcome the problems with MSDOS/BIOS not being reentrant, I captured all the relevant interrupts and set up a semaphore so that I only switch tasks when the BIOS/DOS is not being accessed (i.e., I treat it like a critical region). The trouble is, once I take the interrupts, my program goes wild. I am almost certain that my capture code contains no obvious bugs. I am simulating an INT by pushing the flags saved from the real INT and then doing a long call. When I get back, I update the real flags. The only other things I do are increment/decrement the semaphore and check if a "HOT KEY" request is pending. WHATS HAPPENING? WHY DON'T IT WORK?

By the way, I am plugging the interrupts direct, not asking DOS nicely for them. Also, I wondered if perhaps something in the BIOS 'backs up' over its interrupt for any reason. Otherwise, what's the difference between a real interrupt and PUSHF/CLI/CALL FAR?

lhm.pc/programming #549, from gperfect (George Perfect), Wed Oct 15 02:50:32 1986. A comment to message 546.

Be careful how and when you perform the inc/dec on return from the original int handler. Inc/dec affect the flags, so you MUST save the flags before decrementing your flag. The following code works:

```
pushf          ;Simulate an interrupt
call far ptr oldint
; Now decrement flag and return correct results
```

```
;
;Save flags to be returned
dec word ptr MYFLAG
popf          ;Restore flags after change by DEC
iret         ;Return to interrupted process
```

I assume you have already incremented your flag prior to above code (actually, I just forgot it!).

lhm.pc/programming #550, from skluger (Sigi Kluger, Definicon Systems), Wed Oct 15 13:25:44 1986.

I have a program that uses the DOS EXEC function (4Bh) to execute another program. After the call returns, I use function 4BDh to get the return code and I always get 0 back. Why?

lhm.pc/programming #551, from mws (Mark Shurtleff), Wed Oct 15 15:02:43 1986. A comment to message 550.

What program are you EXECing? If it is a standard DOS utility, only BACKUP and RESTORE ever return a valid code, all others give you a 0. If it's a program of your own, does it terminate using Fn 77 (4Ch) with the return code in AL? More info, please.

M S
W

lhm.pc/programming #555, from skluger, Thu Oct 16 01:06:19 1986. A comment to message 551.

Any program I EXEC, including a test program that only consists of a MOV AX,4C55h followed by INT 21h, returns 0. I do the exec, immediately followed by INT21/4D, and get zero. Every time. All the time.

lhm.pc/programming #556, from dmick (Dan Mick), Thu Oct 16 01:10:53 1986. A comment to message 555.

Um...bug? I've never tried it, but I will. It should be pretty easy to trace the 4Dh call, as it doesn't seem to do much.

lhm.pc/programming #560, from mws, Thu Oct 16 16:39:02 1986. A comment to message 555.

Every time. Can I ask a very dumb question? Are you testing *AL* for the return code? *AH* indicates the program termination using Fn 77 (4Ch), and will return the following codes:

```
AH = 0 --> Normal Exit
    = 1 --> Exit by Ctrl/Break or Ctrl/C
    = 2 --> Exit by Critical Error
    = 3 --> Exit by TSR
```

Does this help, or do I reiterate something already known?

M S
W

lhm.pc/programming #561, from skluger, Thu Oct 16 17:10:41 1986. A comment to message 560.

Since I'm "really" interested in the return code I'm, of course, examining AX.

lhm.pc/programming #563, from geary (Michael Geary), Fri Oct 17 07:21:17 1986. A comment to message 561.

Here's a little test of EXECing a child process and checking its return code.

This is test1.com, it EXECs test2.com and then breaks at 0129 with the return code in AX, or at 012A if there were any errors. (Only run this under Debug, because of the INT 3s!)

```
-u 100 12a
2394:0100 BC0002      MOV     SP,0200
2394:0103 BB2000      MOV     BX,0200
2394:0106 B44A        MOV     AH,4A          ;"J"
2394:0108 CD21        INT     21
2394:010A 8C0E4401     MOV     [0144],CS
```

continued

developing glass substrates for use in high-capacity sputtered thin-film disks. The joint venture says the first glass disks will let designers build 5¼-inch Winchester drives with capacities as high as 90 megabytes and 3½-inch drives that can store 40 megabytes. . . . **Infoscience Services** (Northbrook, IL) has scheduled its Computer Aided Laboratories Symposium and Exhibition for May 12-14 at the Sheraton O'Hare in Chicago. The symposium will focus on laboratory automation and will include sessions on lab networking, communications, chemometrics, artificial intelligence, robotics, and data acquisition. To acquire more data, phone (312) 291-9161. . . . **MicroPro International** (San Rafael, CA) said it's planning a new version of WordStar 2000 for this year, which will have desktop publishing features, and a publishing package being designed by Island Graphics. . . . Vanna White fans, get ready. **ShareData** (Chandler, AZ) will be coming out with software games based on television shows "Wheel of Fortune," "Jeopardy," and "Family Feud." . . . We'd like to close with a fond farewell to **The Homebrew Computer Club**, which held its last meeting in December. Long-time moderator Lee Felsenstein said the group, which served as a breeding ground for computer innovations and Silicon Valley companies, would meet again on "special occasions." At the last meeting, one member speculated, "If it wasn't for Homebrew, the first personal computer might have come out of Route 128 in Boston and been called The Maple or something."

Art and Technology a Wonderful Mix; Remember, Michelangelo Was an Engineer

Akram Midani, dean of the College of Fine Arts at Carnegie Mellon University (Pittsburgh), stated in a recent interview that, contrary to popular belief, art and technology have historically been closely intertwined and that computers will have a tremendous impact on art, probably creating new art forms. Midani thinks the debate between art and technology is somewhat artificial. The artist, he says, deals with a whole body of technical knowledge of some sort. Midani points to Leonardo da Vinci and Michelangelo as artists who were highly proficient in technology. Leonardo's technical prowess is well known, but few realize that Michelangelo was also an engineer and an architect.

We are now, according to Midani, at the very early stages of development of art with a computer. Rock music, says Midani, explores technology fully. Much of today's rock is the result of devices such as synthesizers, digitizers, and samplers.

Midani thinks too many computer artists expend too much effort on the same old thing: creating printouts. He

claims computer artists are merely trying to create prints without getting their hands dirty. Computer art should be "art of time," not just art of space, he says.

He sees four stages in the development of a new artistic technology. In the first, there is an ambiguous fascination with the capabilities of the new technology. In the second stage comes an understanding of the usefulness and efficiency provided by the technology. In the third stage, the new technology begins extending and altering longstanding views. And the fourth stage marks the dawning of a tremendous change, which is really a new art form. Midani believes that computers are now somewhere between the first and second stages.

Microcomputers, according to Midani, are having an enormous effect on art. He compares them to the paint tube, which freed artists from having to mix their own paints and opened up the art form to large numbers of amateurs. Like the paint tube, the microcomputer invites novices to explore the new artistic possibilities of the medium.

Synaptics Hopes to Cast Neural Nets in Silicon

The father of the Z80 microprocessor and one of the developers of silicon compilers have joined a Silicon Valley company that's trying to make computer chips that mimic the nervous systems of animals. If Synaptics Inc. (San Jose, CA) can make the concept work, the payoff could include much faster computers, with far more powerful database management capabilities.

The firm was founded to turn the theories of neurobiologist Gary Lynch into useful semiconductors. Lynch developed a model of how nerve cells transmit and store information, the so-called neural net. Neural nets are much more highly parallel than present-day computers, with processing

power distributed throughout the net. They store and access information based on content rather than a specific location. By casting neural nets in silicon, researchers hope to bring these capabilities to computers.

Among the people working with Lynch at Synaptics is Frederico Faggin, who worked on the design of the 8080 microprocessor for Intel and then moved on to cofound Zilog and help design the Z80. The company's most recent acquisition is Carver Mead, who helped develop silicon compilers to speed the process of turning chip designs into silicon. In addition, Mead is an expert on how the neurons in the human eye process data.

Atari to Roll Out Number-Crunching STs

Atari Corp. (Sunnyvale, CA) confirmed that it plans to introduce 32-bit-based ST workstations sometime in the second half of this year. "Basically there are two hardware components: a number cruncher and a higher-resolution ST," said Neil Harris, director of

marketing communications for Atari. "The number cruncher plugs into the DMA port on either the current ST or the enhanced-resolution ST."

Harris said the "number cruncher" is a 68020-based system with a math coprocessor (68881) and memory man-

agement unit. It will run UNIX System V software "or something close to it," said Harris. The workstation will use the Atari ST as a front end or as a kind of "genius terminal" (using the DMA port) and the ST's keyboard, graphics, and other I/O.

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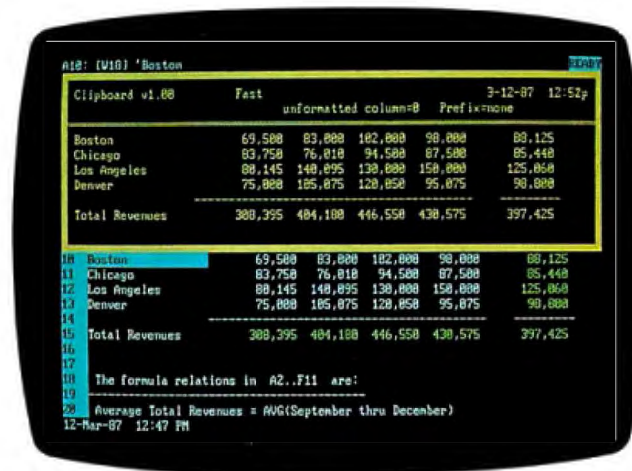
Contact: Adobe Systems Inc., 1870 Embarcadero Rd., Palo Alto, CA 94303, (415) 852-0271.

Inquiry 576.

Atari's PC Clone

The Atari PC is the company's first move into the world of IBM clones. The low-cost system is based around an 8086 microprocessor running at either 4.77 or 8 MHz. There's also a socket on the motherboard for adding an 8087 math co-processor.

The system comes with a single 5¼-inch floppy disk



The screenshot shows a window titled "Clipboard v1.00" with a menu bar (File, Edit, Format, Window, Help) and a status bar (3-12-87 12:52p). The main area displays a table of city revenues. A yellow highlight is on the "Clipboard v1.00" title bar. Below the table, a text box shows the formula "Average Total Revenues = AVG(September thru December)" and the date "12-Mar-87 12:47 PM".

	Fast	unformatted column=0	Prefix=none
Boston	69,500	83,000	182,000
Chicago	83,750	76,810	94,500
Los Angeles	88,145	140,895	130,000
Denver	75,000	105,075	120,050
Total Revenues	308,395	404,180	436,550

10 The formula relations in A2..F11 are:
20 Average Total Revenues = AVG(September thru December)
12-Mar-87 12:47 PM

Clipboard, one of Metro's pop-up application-management tools.

drive and has provisions for an external 5¼- or 3½-inch drive. It comes with 512K bytes of RAM, and memory can be expanded to 640K bytes on the motherboard. On the rear panel, there are serial, parallel, video, and Atari ST-style disk ports. There's also a mouse and a mouse port based on Microsoft's Inport chip. There's no room in the box for adding circuit cards, but the company says it will introduce an external expansion box later.

For graphics, the Atari machine provides Hercules, IBM monochrome, CGA, and EGA capabilities. An optional monochrome monitor supports all the display modes using gray scales to represent color.

The Atari PC system unit measures 22 inches square by 2 inches high and comes with an "XT-style" keyboard. The company claims that it's 100 percent compatible with software designed for the IBM PC.

Price: \$699 with monochrome monitor and EGA capability; \$499 less monitor and EGA capability.

Contact: Atari, 1196 Borregas, Sunnyvale, CA 94088, (408) 745-2000.

Inquiry 577.

Pop-Up Desktop Accessories with Metro

Metro, a memory-resident desktop manager from Lotus Development Corporation, can be used as a companion to 1-2-3, Symphony, Manuscript, and other Lotus programs or can be used alone.

The program's pop-up application-management tools include a text editor, a DOS file manager, a clipboard, an HP-12C-style financial calculator, a notepad, a phone book, a list manager, and a macro generator. You can configure your system's memory by loading in the application tools that you need. The text editor offers word processing capabilities in a familiar Lotus interface and enables you to create and edit files without leaving 1-2-3, Symphony, or other application programs you're working with. The clipboard lets you cut and paste data between Metro and other Lotus application programs, and the DOS file manager formats disks and creates subdirectories also without leaving the main application.

Metro's macro generator features a command language, which includes IF...THEN branching with variable definitions and GOSUB routines. A learn mode records a series of keystrokes and commands that you can execute with a single key. The generator also enables you to create your own menus, templates, and text screens.

The program uses the same TSR (terminate but stay resident) kernel used by the Lotus Express communications program. Metro is based on Lotus's adaptation of Spotlight, a TSR-based program created by Software Arts, a recent Lotus acquisition. In creating Metro, Lotus added to Spotlight the memory configuration capability, text editor, list manager, DOS filer, clipboard, and macro generator. Spotlight users can upgrade to Metro for \$40, Lotus reports.

To run Metro, you'll need an IBM PC, XT, AT, or compatible with at least 80K bytes of RAM available for the RAM-resident portion of the program. MS-DOS or PC-DOS 2.0 or higher is necessary, along with two floppy disk drives. (Lotus recommends a hard disk drive for optimal performance.)

Price: \$85.

Contact: Lotus Development Corp., 55 Cambridge Parkway, Cambridge, MA 02142, (617) 577-8500.

Inquiry 578.

Four New 80386 Products

Intel Corporation has introduced four new products for the 80386 line.

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Formatting text into columns has its trade-offs: Graphics larger than one column wide are automatically cropped to fit. These can be resized or you can include a larger-than-column-size graphic in the header or footer.

• **Full View.** To make exact formatting possible, WriteNow allows you to view a document in several different ways. You can examine the normal typing area by simply viewing the page, while headers,

footers, and footnotes have their own window to illustrate their ruler setup and spacing. Particularly valuable options include the ability to view while showing markers, which graphically illustrate all headers, footers, time and date insertions, soft hyphens, and page numbers; and the ability to view while showing space, which provides a dotted outline around your text that depicts page margins and header and footer boundaries. It also shows all non-printing characters, such as return characters, spaces, tabs, and page breaks.

• **Spelling Checker.** WriteNow uses a menu-driven 50,000-word dictionary to check the spelling in a document. The spelling checker includes several helpful buttons. The Find button finds the next word not included in the dictionary. The Guess button lists alternative spellings for a questionable word. Learn adds a word to the dictionary, Forget removes a word from the dictionary, Ignore skips a word designated as misspelled, and Load Dictionary uses a dictionary of your choice.

• **Import/Export.** Included on the disk with WriteNow is a program called Translator, which can take a MacWrite or Microsoft Word document and translate it with much of its formatting into a WriteNow document. The program also translates files in standard text format into WriteNow's format and allows you to save a WriteNow document as ordinary text. The latter capacity allows WriteNow to import and export documents to database programs or spreadsheets.

Finishing Touches

WriteNow includes a number of finishing touches, that is, small logical jumps from MacWrite that allow you a little more control. For example, the Find and Replace command can use wild cards. The ruler

includes a point-by-point spacing toggle, and the page-break symbol is a broad, shaded band (no isolated "=", as in Microsoft Word). You can change default ruler settings by including a piece of stationery in the same folder as WriteNow. You can increase or decrease font size with a key combination. You can insert soft hyphens for better formed text and set off paragraphs by indenting left and right from the Format menu. You can also alter the distance between letters (kerning) to optimize printing and add and insert a variety of headers and footers on different ranges of pages. This is not an all-inclusive list of WriteNow's features, but it does give you some insight into the program's sophistication.

The program comes with a well-written and nicely illustrated 175-page manual containing a user's guide and a reference section. T/Maker has joined the growing group of software developers issuing unprotected software, so there is no problem with backups or installing WriteNow on a hard disk. I found the program very solid, fast, and predictable.

Like Laser Author (which I reviewed in the January issue of BYTE), WriteNow is not the complete Macintosh word processor. The biggest reservations I have concern its inability to merge text to produce form letters and the lack of a glossary for easy entry of boilerplate phrases or blocks of text. If you have no need for these features, WriteNow for the Macintosh is well worth a look. [Editor's note: See table 1 for complete benchmark results.] ■

Mick O'Neil (Box 544, APO, NY 09378) is a computer coordinator for the U.S. Department of Defense dependent schools in the U.K. and a freelance writer for several international journals.

CAD-3D

Rusel DeMaria

CAD-3D from Antic Software is a three-dimensional modeling program for the Atari ST. Written by Tom Hudson, author of NEOchrome and DEGAS, CAD-3D offers sophisticated control of wire-frame or solid objects in up to four simultaneous views. The program allows you to control up to 20 objects, join or animate objects, and export color pictures to paint programs like NEOchrome and DEGAS.

When you first load the program, the screen displays four windows and a group

of pull-down menus. Each window contains a different view of the objects you create. Three of the windows offer a choice of views. For instance, one window offers a view either from the right or the left side. The others offer top and bottom or front and back views. You can select or change the settings in these view windows at any time. By pressing the button in the upper left corner that normally closes a GEM window, you toggle the size

continued

CAD-3D version 1.0**Type**

Three-dimensional modeling system with animation capabilities

Company

Antic Software
524 Second St.
San Francisco, CA 94107
(415) 957-0886

Format

One 3½-inch disk; not copy-protected

Computer

Atari 520ST or 1040ST with at least 512K bytes of memory; one disk drive (second drive recommended)

Language

C, assembly language

Documentation

User's manual, 30 pages

Price

\$49.95

and rotation controls for each window. Scroll bars at the bottom and right side of each window control these functions.

The fourth window is the Camera window. It allows you to view objects as if from a camera. You can change the amount of perspective, zoom in and out, and rotate the camera relative to the three-dimensional images. You can also take a Super View, or color snapshot, of the image in the Camera window. On monochrome systems, you can get a high-resolution image of the Camera view.

You can zoom any window to full-screen size and activate or deactivate any window you choose. With more complex objects and shading it can take quite some time to redraw the screen in each window, so closing nonessential windows speeds up the performance of the program.

All commands are available using GEM-like pull-down menus, and most of the commands have keyboard equivalents as well.

Creating a CAD-3D Object

Several standard objects are available under the Generate menu. You can create a cube, three increasingly complex spherical objects, a wedge, or a torus (doughnut) shape. If one of these shapes is not what you want, you can use the Spin and Extrude tools to create more complex objects.

Spin is essentially a lathe tool. You work on the right side of a special connect-the-dots-type screen and define a figure one point at a time for up to 32

points. Any figure you outline is mirrored on the other side of the dividing line. When you are satisfied, you use the Do Spin command, creating a three-dimensional object that follows the outline you have created. This is an excellent tool for creating radially symmetrical objects like goblets, light bulbs, vases, or bowls.

Optional features include Rubberband, which shows the connecting line from the last point created; Connect, which automatically closes a figure; Grid, which shows an even grid; and Snap, which automatically moves points onto grid lines for more precise control. Also, you can remove erroneous points or use the Undo key to back out of an error.

Extrude is another tool for creating a new object. It is similar to Spin, but you can use it to create asymmetrical objects. It works on a similar screen, but in this case you use both sides of the center line. You must draw clockwise and avoid crossing or intersecting lines, but otherwise you can draw virtually any outline you wish (up to 50 points). You can also use the Grid, Snap, Rubberband, Remove, and Undo options. Extrude automatically closes all figures, so Connect is unnecessary here.

With both Spin and Extrude, you can select the number of segments—up to 50 with Extrude and up to 48 with Spin—that the figure will contain. This is especially useful with round figures, since increasing the number of segments increases the smoothness of the object. It also increases the time it takes to draw and redraw the object.

After you have created objects, you may want to join them. Joining objects allows you to create complex three-dimensional models and allows you to exceed the 20-object limit effectively. You can achieve several effects with the Join command. Besides simply adding two objects to make a third, you can subtract the overlapping area of one object from another, create an object that consists of only the overlapping part, or stamp one object onto another, creating a two-dimensional image of one object on the surface of another. Most Joins go quickly, but with very complex objects the process can take quite a long time—up to several hours. In some cases, two planes on the joining objects may exactly match. If this is the case, you must move or rotate one of the objects at least one degree to allow the Join.

Manipulating Objects

After you are satisfied with the objects you have created, you manipulate them. You can select wire frame (the default), hidden lines, solids, or outlined shapes. Selecting Edges Only with the Outline mode shows a clean solid shape with all

facets visible. This is my favorite way to view objects. Whatever display you prefer, you can select and deselect objects on the screen, drag them to new positions, or use the scroll bars to resize or rotate them.

With solid models you can use up to four different light sources to achieve different shading effects. Although objects display on the screen in monochrome, in Super View each object can display in one of two different colors, and you can have up to seven different shadings of those colors. You set your light sources for one of seven intensity levels and for direction. For three light sources, you can choose any combination of top/bottom/center, right/left/center, and front/back/center. The fourth light source is ambient light, for which you choose the intensity. You can also display Super View objects in 14 shades. This mode creates pastel effects but allows only one color at a time.

To select an object, you simply double-click on it; other objects then disappear from the display. You can select any combination of objects from the Select option under the Objects menu and drag any object to a new position in any window except the Camera view. You can also set the program to drag only vertically or horizontally for more precise positioning.

You can scale objects from 50 percent to 500 percent. The Scale command works in all three dimensions, whereas sizing in the windows works on only one dimension at a time. You can also select Rotate from the Objects menu. This command causes the object to rotate in one dimension. With both Rotate and Scale you can use either the Universe or the Group mode. Universe mode rotates and scales relative to the center of the three-dimensional universe. Group mode rotates or scales relative to the center of the currently selected group of objects.

One use of the Group mode is to create an animated spinning object. Rotating a single object set for Group mode causes it to spin on its own axis. If the setting is for Universe mode, the object will rotate around the universal center instead of spinning.

Animation

Possibly the most impressive aspect of CAD-3D is its animation. Beta versions of the program allowed a slow, space-consuming type of animation, but the techniques are improving rapidly. Currently you can have animation moving at up to 60 frames per second; broadcast quality is only 25 to 30 fps. Also, compression techniques allow you to store much more data on a single floppy disk. At the time of this writing, the program allowed up to 20-to-1 compression, but Antic prom-

continued

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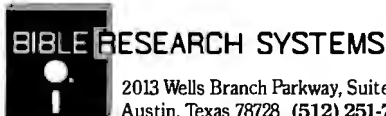
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ises 100-to-1 compression or greater in the near future. Antic estimates that you will be able to contain an entire hour of real-time three-dimensional animation on a single double-sided floppy disk.

To animate, you must take a Super View picture of your scene, save it, modify the scene, change it, and take another picture. Each picture you save is a single frame in the animation. Thus, producing complex animation can be time-consuming and tedious; however, the results are excellent. By using CAD-3D's tricks, you can zoom in and out of scenes, change lighting effects, add and subtract figures, and produce complex movement of various kinds.

What Makes CAD-3D Special

Antic has already released into the public domain several disks of three-dimensional figures. Antic also promises a number of other related programs and image collections for early 1987. Liquid-crystal-shutter three-dimensional glasses developed by Tektronix will be available from Antic in early 1987 for use with CAD-3D. I've seen both still and animated scenes using the glasses, and the effect is amazing. In a darkened room, you would swear that objects float five or six inches in front of the monitor screen. [Editor's note: *At press time, Antic planned to release CAD-3D 2.0 in early 1987. The new version will include an icon interface, integer math for real-time processing, and dimensioning capabilities. It will be bundled with an animation language and will cost \$89.95.*]

A Bargain

CAD-3D is an impressive program for creating, manipulating, and animating three-dimensional graphics. It lacks some of the abilities of other CAD programs, namely autodimensioning and labeling. Therefore, it is more appropriate as a design and animation tool than as a drafting tool. Also, you can't create the outline of an object in all three dimensions. To achieve complete control, you must use the Join command. Extrude allows you to create asymmetrical objects, but you can control only two dimensions. Finally, the manual is adequate but not as impressive as the program. Some additional tutorials might be useful to people new to three-dimensional modeling.

Whether you want to send pictures to two-dimensional paint programs like NEOchrome or DEGAS, print pictures out on a printer or plotter, or use the growing number of available animation tools, you should find CAD-3D an excellent program. At \$49.95, it is a bargain. ■

Rusel DeMaria (109 Akea Place, Kula, HI 96790) is a freelance writer and computer consultant.



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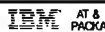
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amigo/softw.devlpmt #3074, from w.volkoeigis (William Volk, Aegis Development, Inc.), Mon Nov 17 16:31:25 1986. A comment to message 3063.

Creating a mask is the more efficient way to do a ClipRegion on the Mac. The Mac, I gather, has a rather high-powered multipolygon clipper, hence the region stuff.

amigo/softw.devlpmt #3079, from dhubbord (David Hubbard), Tue Nov 18 21:46:16 1986. A comment to message 3063.

Regarding circle generation, there is a good discussion in "Fundamentals of Interactive Computer Graphics" by Foley and Van Dam (Addison-Wesley). Also, check out "Microcomputer Displays, Graphics, and Animation" by Bruce Artwick (of Flight Simulator fame) (Prentice-Hall). A custom routine sounds like best bet. Dave H.

amigo/softw.devlpmt #3085, from mthant, Wed Nov 19 19:26:51 1986. A comment to message 3063.

I talked to Carolyn at Commodore, and she said the reason everything was so slow was because I had a high-res 4-bitplane screen opened, and that was slowing down Intuition. (Beat that!) Anyway, I got things going at a reasonable rate and I could always close the Workbench screen to speed things up. (Oh boy, here come the cries from those who desire multitasking....) But the fact is I can't spare any bitplanes, so.... By the way cheath, I'm writing a game on the Amiga, a surgery game, and I was displaying an EKG pattern on the screen, which is supposed to be "real time," but as I moved the mouse (to cut into the patient for instance) the EKG slowed down. Too much actually, but now it's a little better. Ideally, I'd like it to be in a separate task, and timed, but I haven't figured that out yet!

Oh well. As for the masking with the ellipses, that's what I'll do. Right now I'm having sprite troubles. (I can only get one sprite on screen at a time; as soon as I put a second one up, the first one disappears!) I'll fix it.... Thanks. J.K.

amigo/softw.devlpmt #3087, from cheath, Wed Nov 19 19:50:14 1986. A comment to message 3085.

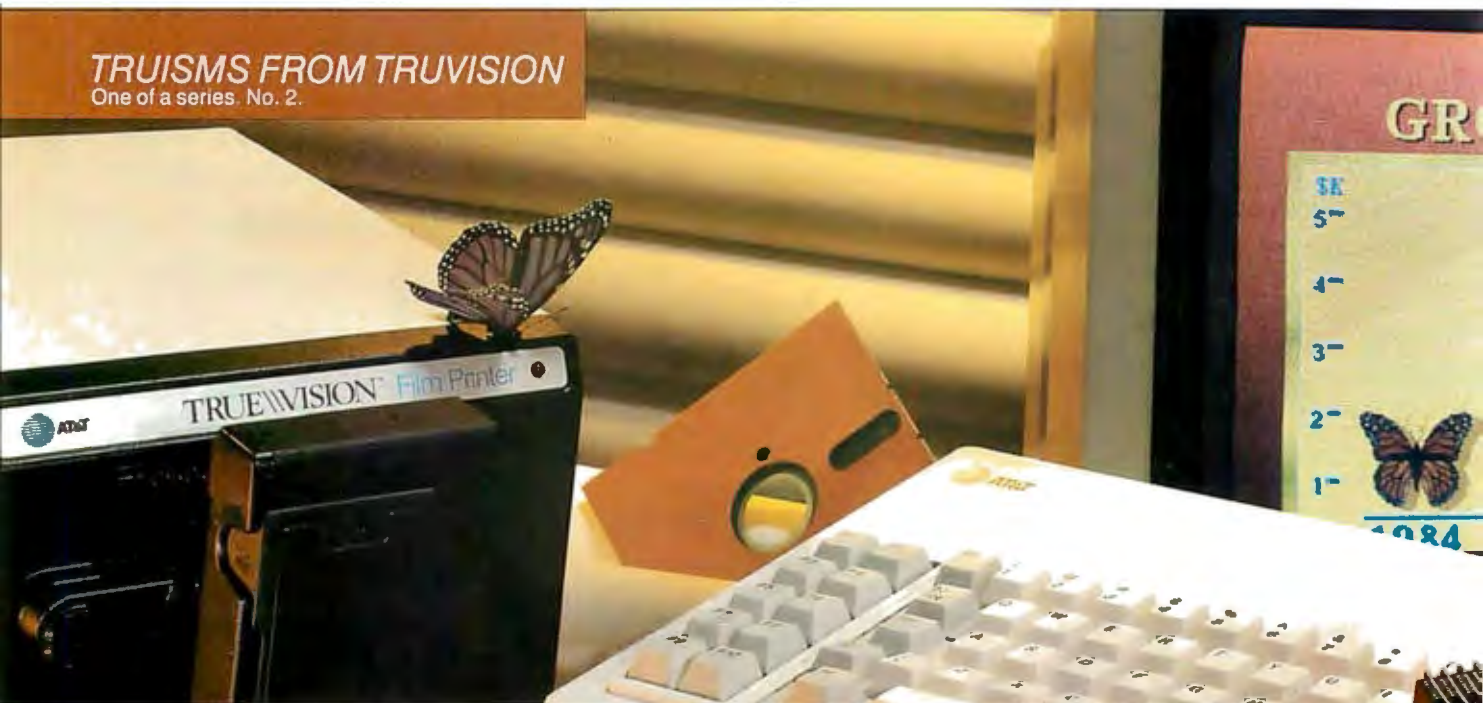
That's tough with 4 bitplanes HIRES. It's okay to close down the Workbench screen if it's done through the Intuition calls and it is reopened when you exit. You can't guarantee it will be closable, though, because there must be no windows open in it except for the WBench windows, else it can't close. However, that's not likely to improve your speed, because the WBench screen doesn't use any extra cycles unless it is being displayed. The only way I can think of to improve speed is to install yourself ahead of Intuition in the input.device, and snarf up the MOUSEMOVE events. You'd need to think through a lot of possibilities to make sure this works safely. For an example, check out how "Grabbit" works. For implementation, the closest thing to an example I know of is popcli, and the chapter on input.device in the RKM.

ATARI ST

The Atari ST section begins with a long thread discussing the disk format used by the ST. Access speed, FATs, and similarities to the IBM PC format are mentioned. The second thread concerns itself with

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reading Shift/Control/Alt keys in conjunction with other keystrokes from within a C program.

ST DISK FORMAT

atari.st/tech #1216, from dmichael (Michael DeCorte),
Thu Nov 13 23:51:55 1986.

First, does anyone have some suggestions as to where I can find some accurate information on the disk format for the ST from the software point of view (where and how are the directories and stuff like that - not what are the sector gaps)? I understand the STs have the same format as the IBM; is this right? Second, can the first 2K of the ST be modified? I want to change the BIOS calls. In other words, is the first 2K in ROM? I am going to try a program (might be an accessory) that will change the disk I/O routines so that they do disk buffering. Should speed things up about 5 times so that sequential disk access is on par with the IBM, Amiga, and Mac.

P.S. The name of a book would be just fine for disk format info.

atari.st/tech #1217, from sprung (Ron Sprunger), Fri
Nov 14 01:27:38 1986. A comment to message 1216.

The directories start on track 1, sector 3 for single-sided, and track 0, sector 3 for double-sided (side 1). Format is the same as IBM, but I don't have the details at hand as to how the offsets are referenced, etc.

As for the first 2K of memory - it's not in ROM, but it IS protected. The details are in the Hitchhiker's Guide (DevPak); the Abacus books probably have it as well. David Small had an excellent article about the controller in the last issue of STart, along with a raw

sector-read program. I'm told you can speed it up considerably if you turn off error checking. The drives are not slow, but in sequential reads, they turn off while you process - you might want to just leave them on to speed things up.

atari.st/tech #1218, from dmichael, Sun Nov 16 01:40:46
1986. A comment to message 1217.

Thanks for the info. I will look in Hitchhikers. As for the drives not being slow - I did a few tests a while back. I used program loads, a file copy, and data loads as tests. The conclusion that I came to was that the ST reads 1 sector/revolution. That's 512 bytes/sector * 1 sector-read/rev * 5 rev/second = 2560 bytes/second. Not good. On the other hand, assuming 9 sectors/track, you could read 512 * 9 * 5 = 23040 bytes/second. This is the best possible time and is optimistic, but people have increased sequential I/O fivefold using a simple track buffer. It kills almost 5K, but I have a meg here, so 5K won't kill me.

atari.st/tech #1221, from sprung, Sun Nov 16 13:10:05
1986. A comment to message 1218.

>1 sector per revolution...

I hope that's on a badly churned disk; that is, where the sectors have been really spread around. For track reads, the XBIOS routine FloppyRead is easy, but make sure you have the updated version from listings and, of course, you'll have to figure from the directory just what it is you want to read. I use it for disk copies, and they go fast enough. If you really want to change the BIOS, I wonder if Dave Small's approach would serve. In The Amazing MouseTrap, he installs and stays resident, but changes the trap-14 vector to himself, so

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that he can intercept and act on right button clicks, but pass all else through to TOS. (Hope I didn't mangle that too badly.)

atari.st/tech #1273, from dmichael, Sat Nov 22 01:47:57 1986. A comment to message 1221.

1 sector per rev. That's the timing I got for file transfers and program loads. About changing the trap - you read my mind.

atari.st/tech #1222, from dsmall (David Small), Sun Nov 16 15:44:44 1986. A comment to message 1218.

The problem with track buffering is going track to track. Atari uses a seek-with-verify that manages to miss the first sector of the next track on chained reads; hence, you always lose one rotation. TOS adds a fierce amount of overhead.

atari.st/tech #1303, from ianl (Ian Lapore), Thu Nov 27 02:43:07 1986. A comment to message 1222.

I hope everyone is familiar with the formatting utilities that correct this seek-with-verify timing problem. I first ran across it in Analog, in the form of a program called FORMAT PLUS. This BASIC program requires TOS in RAM. It changes the BIOS format routine such that subsequent disk formatting results in a different track layout.

I started analyzing the track format it creates, in hopes of writing a C program to do the format... primarily to eliminate the need for a RAM TOS. Several beat me to it (QFORMAT.PRG, et al.). What I did determine was that the number of slack bytes between sectors was reduced slightly, and the resulting extra room was used to add a "dummy" sector or two to the end of the track. This (apparently) provides time for a seek-with-verify to happen without the start of track marker flying by, and the resulting 1-rev wait for it to come around again.

Using disks in this format, and turning off the write-verify switch, truly DOUBLES floppy I/O rates. (As long as track-sized reads/writes are being done.) The track format is still 9 sectors per, with no interleaving. As far as the BIOS/XBIOS/GEMDOS routines are concerned, it is a standard format disk. If need be, I can upload a couple of the programs that do this formatting. I swear by this. I couldn't go back to the standard format disks and still get any work done.

atari.st/tech #1219, from jtittsler (Jim Tittsler, Atari Corp.), Sun Nov 16 12:42:38 1986. A comment to message 1216.

The best source of information about the ST disk format is to use the Hitchhiker's Guide to the BIOS in conjunction with your favorite MS-DOS document (I might suggest one of Peter Norton's books like "Inside the IBM PC," but I won't). The Guide will explain the layout of the boot sector, including the prototype BPB. The MS-DOS reference should fill you in on how to interpret that in terms of FATs and directory space.

atari.st/tech #1272, from dmichael, Sat Nov 22 01:45:33 1986. A comment to message 1219.

Thanks for the book name. It should contain the info that I am looking for. Hitchhiker's is fine if you know how the FATs and directory are interpreted, but not very good if you don't.

atari.st/tech #1274, from sprung, Sat Nov 22 01:50:45 1986. A comment to message 1272.

Yes, I had to do some FAT stuff today, and found the Norton book ideal for the purpose. It doesn't necessarily tell you exactly where everything is, but it gets you close enough that you can find it with a sector dump. It's the first time I ever understood how FATs work; now I can actually find a file or directory reliably with sector dumps.

atari.st/tech #1220, from jtittsler, Sun Nov 16 12:44:57 1986. A comment to message 1216.

No, the first 2K of the ST are only accessible when the 68000 is in supervisor mode. (The physical reset vector comes from the first 8 bytes of ROM.) Software can enter supervisor mode and modify the "system RAM."

atari.st/tech #1302, from ianl, Thu Nov 27 02:41:17 1986. A comment to message 1216.

About disk buffering...I did a _little_ work on this a while back. I'll toss out what I learned.

You want to hook into the hdv_rw vector (at \$476). Even though it's not documented as such, it seems that ALL sector-oriented reads/writes go through here, even the floppies. Resist the temptation to hook the TRAP 13/14 handler to catch floprd/flopwr calls. It's a pain in the neck.

The application I was working on was write-through caching for either floppy or hard drives. I was working it such that the writes went into cache, then were passed along to the regular handler (the old value in the vector). A read would be checked against the cache map. If I could return ALL the sectors requested, I handled it, and the regular handler never saw the call. Otherwise, I would count the accesses to the sector(s), and when the counter got to a certain value, that sector would be cached. Unfortunately, this never got finished, due to problems sensing and dealing with media changes on the floppies. (Actually, I can SENSE a media change okay, I just can't seem to clear it afterwards. The work proceeds...slowly). Anyway, I hope this helps.

STATUS OF SHIFT/CONTROL/ALT KEYS

atari.st/tech #1254, from dbetz (David Betz, Senior Editor, BIX), Fri Nov 21 10:21:25 1986.

How do I determine if one of the Shift/Control/Alt keys was pressed along with a keystroke fetched with bconin()? The getshift() function tells me the current state of the modifier keys, but since the ST buffers keystrokes, it is possible that the current state does not correspond to the state at the time of the actual keystroke.

atari.st/tech #1255, from sprung, Fri Nov 21 11:21:58 1986. A comment to message 1254.

According to Hitchhiker's Guide, "If bit 3 in the system variable 'conterm' is set, then the high byte of the upper word will contain the value of the system variable 'kbshift' for that keystroke. [The default state for 'conterm' is OFF.]" Conterm is at \$484.

atari.st/tech #1260, from dbetz, Fri Nov 21 11:41:24 1986. A comment to message 1255.

Thanks! That's just what I needed to hear.

atari.st/tech #1261, from jim_kent (Jim Kent), Fri Nov 21 14:45:56 1986. A comment to message 1260.

Try looking at the high word that cconin() returns normally. Don't think you need to check the system variable. It will be 0 if nothing fancy is pressed, otherwise the high word will tell you about arrow keys, Alt keys, and other good non-ASCII stuff.

atari.st/tech #1291, from mpack (Don Milne), Wed Nov 26 12:51:40 1986. A comment to message 1261.

Jim, I don't think that conin returns when only the Alt key is pressed, and if you press any other key, the high word contains only the scan code (not modified by Alt). So if you want to interpret the key differently when Alt is active, you are still left with the problem

continued

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of detecting Alt at the time the key is pressed. Ron's solution should handle this easily.

atarl.st/tech #1295, from neilharris (Neil Harris, Atari Corp.), Wed Nov 26 13:13:15 1986. A comment to message 1291.

You can use the BIOS function 11 (kbshift) to read only the shift status. This function returns the following codes:

Bit	Meaning
0	Right shift key
1	Left shift key
2	Control key
3	Alternate key
4	Caps Lock on
5	Right mouse button
6	Left mouse button
7	unused

atarl.st/tech #1298, from hlsft (Andy Pennell, HiSoft), Wed Nov 26 13:42:55 1986. A comment to message 1295.

Kbshift (BIOS call 11) will *not* return the mouse buttons as documented, though the keyboard bits do work. The BIOS routine reads a system variable at \$e1b, but, sadly, this has nothing to do with the mouse. Another "feature" of Hitchhiker's I guess.

atarl.st/tech #1306, from jtittsler, Fri Nov 28 12:31:44 1986. A comment to message 1298.

Actually, what the kbshift BIOS call is documented as doing in the Hitchhiker's Guide IS correct, but open to misinterpretation, admittedly. It says

0	Right shift key
1	Left shift key
2	Control key
3	Alt key
4	Caps Lock
5	Right mouse button (CLR HOME)
6	Left mouse button (INSERT)
7	(reserved)

What bits 5 and 6 are used for is returning the state of the keyboard mouse button equivalents, Alt/Clr Home and Alt/Insert, not the physical mouse button states. The other thing that might need clarification is that the Caps Lock bit indicates the current state of Caps Lock as if it were implemented with a locking push-button; rather than indicating the switch is closed, it will toggle with each Caps Lock keypress.

atarl.st/tech #1289, from mpock, Wed Nov 26 12:50:16 1986. A comment to message 1255.

>bit 3 in "conterm" forces return of kbshift states...

Thanks, Ron. I have a use for that information myself. I wonder why it defaults to off? Is there some disadvantage to having it returned all the time?

atarl.st/tech #1309, from sprung, Sun Nov 30 00:15:04 1986. A comment to message 1289.

I don't know, but it seems a pain to have to go supervisor just to tell the machine you want all the keyboard info, doesn't it?

atarl.st/tech #1312, from dbetz, Sun Nov 30 09:14:30 1986. A comment to message 1309.

I have run into problems with some programs if I leave bit 3 on. They seem to think that they are going to get a value from 0 to 255 from the high word of beoin() and crash when they try to use the full value with the shift bits as an index into a table.

continued

Price: \$1995 for PC Convertible with new screen.

Upgrades for current owners: \$250 (screen); \$390 (memory expansion); \$450 (modem).

Contact: IBM Corp., 900 King St., Rye Brook, NY 10573, (201) 358-5677.

Inquiry 587.

Processing Text and Graphics on the Apple II

Charts Unlimited from Graphware is a graphics and text-processing program that runs on 64K RAM Apple IIs and enables you to create, edit, and print full-page flowcharts and organizational charts.

The worksheet is 123 columns by 90 rows. Although the entire worksheet is not visible at one time, a feature called View lets you shrink it to one-eighth its normal size and display it on the right side of your screen.

Flowchart objects, boxes, and geometric shapes are included. And you can make use of the program's text-editing capabilities to enter, insert, and delete characters on the worksheet. You can print full-page charts vertically or horizontally in enhanced or normal print on most dot-matrix printers, according to Graphware.

Price: \$49.95.

Contact: Graphware Inc., P.O. Box 373, Middletown, OH 45042, (513) 424-6733.

Inquiry 588.

Digital Audio on a Floppy Disk

The Antex Model VP 600 is a half-length card for the IBM PC and compatibles that converts voice-frequency audio into digitally encoded waveforms for storage on a floppy disk. The board comes with ports for both microphone and cassette input, and menu-driven software for board control is included.



Antex Model VP 600 converts audio to digital waveforms.

The Model VP 600 uses adaptive differential pulse-code-modulation encoding and handles frequencies from 20 Hz to 3500 Hz with a 48-dB dynamic range. Sampling rates of 4 kHz or 8 kHz are selectable. At the 4 kHz sampling rate, an hour of voice recording requires 7.2 megabytes of disk storage.

Price: \$345.

Contact: Antex Electronics Corp., 16100 South Figueroa St., Gardena, CA 90248, (213) 532-3092.

Inquiry 589.

An 80386 Motherboard for the PC

The ZEOS 386/M is an IBM PC AT-compatible motherboard that upgrades IBM PCs, XTs, and ATs to 80386-based systems. The unit has a 16-bit PC AT-compatible bus for peripherals and a 32-bit, 16-MHz zero-wait-state bus for memory.

The 386/M comes with the Phoenix 80386 IBM PC AT-compatible ROM BIOS, and hardware support for the 80386 is provided by Chips and Technologies' seven-chip AT/386 chip set combined with the company's 82C206 integrated peripheral controller.

Sockets are provided on the motherboard for Chips and Technologies' two-chip EGA

and Western Digital's single-chip floppy disk controller. The board has provisions for up to 16 megabytes of fast zero-wait-state RAM. A minimum of 1 megabyte of memory is required.

To ensure compatibility with standard PC/AT/XT expansion boards, the 16-bit PC AT I/O-expansion bus runs at 8 MHz while the system runs at 16 MHz. You can also slow the system down via keyboard commands for software that's dependent on clock speed. A socket for the 80387 math coprocessor chip is also included.

Price: \$1995 (without RAM). **Contact:** ZEOS International, 530 5th Ave. NW, Suite 1000, St. Paul, MN 55112, (800) 423-5891; in Minnesota, (612) 633-4591.

Inquiry 590.

Mega ST has Megabyte Memories

Atari has released new versions of its ST series of personal computers. The Mega ST 1, ST 2, and ST 4 are shipped with 1, 2, and 4 megabytes of RAM, respectively. All have a newly designed 22-inch-square by 2-inch-high system unit that results in a smaller footprint than either the 520ST or

1040ST. They also have detachable keyboards and built-in 800K-byte 3½-inch disk drives.

Additional enhancements to the Mega ST include a battery-backed real-time clock, internal mounting space for an additional circuit board, and full access to the 68000 system bus via an external connector. Atari says it will soon be offering RAM expansion upgrades of up to 16 megabytes.

Atari has also announced that prices will be reduced on existing ST models. The 520ST will retail for "under \$300." A 1040ST with a monochrome monitor will sell for \$899, and a 1040ST with a color monitor for \$1099. **Price:** Starting at "about" \$1000 (final pricing not available at press time). **Contact:** Atari Corp., 1196 Borregas, Sunnyvale, CA 94088, (408) 745-2000. **Inquiry 591.**

Clip-on 68020 Mac Upgrade

The Prodigy Prime Macintosh enhancement board adds considerable power to an existing Macintosh. Included is a 16-MHz 68020 microprocessor, 1 megabyte of RAM, an internal fan, a non-volatile RAM disk, and an additional power supply. The unit is user-installable and clips onto a 128K or 512K Macintosh or a Macintosh Plus motherboard.

Available options include up to 4 megabytes of RAM, a 16-MHz 68881 math coprocessor, a 68851 paged-memory-management unit for expanded memory use, an enhanced SCSI controller that can handle up to 24 peripherals, and an expansion connector for large screen monitors and other devices.

Price: \$1995.

Contact: Levco, 6160 Lusk Blvd., Suite C-203, San Diego, CA 92121, (619) 457-2011.

Inquiry 592.

Two C Compilers

Borland has announced Turbo C, a C language development system. The program implements ANSI C and supports Kernighan & Ritchie C. Borland reports that the system compiles at a rate of 7000 lines per minute on a 6-MHz IBM PC AT.

With Turbo C you can choose to use an integrated environment or a command-line interface.

The integrated environment comes with an editor, compiler, and linker. Its Run operation recompiles all necessary files, generates executable code, runs the program, then returns to the user interface.

In command-line mode you can select compiler options from the command line, the integrated environment, or from a configuration file—without having to set environment variables, according to Borland.

The built-in editor enables you to call and toggle between the editor and the message window. The editor window provides insert/overwrite, auto-indent, and block capabilities. The message window displays error messages. According to Borland, Turbo C steps through multiple errors, and the interactive editor positions the cursor in the source code at the point of error.

Compiler options include an in-line assembler, multiple levels of optimization, generation of 80186/80286/8087 instructions, warning suppression, and multiple memory models. A LINT facility that supports ANSI prototypes is also provided. Other features include a library that supports the IEEE floating-point standard, support for UNIX-compatible routines, supplemental functions for BIOS and DOS calls, and optional Pascal calling conventions.

Price: \$99.95.

Contact: Borland Interna-

tional, 4585 Scotts Valley Dr., Scotts Valley, CA 95066, (408) 438-8400.

Inquiry 609.

Mark Williams Company has announced version 4.0 of the Let's C compiler, which, like Borland's Turbo C, runs on IBM PCs and supports Kernighan & Ritchie C. The new version features in-memory compilation and development features such as 80286 code generation, ROMable code, 8087 math coprocessor support, large and small memory models, and an option for a large and small model source-level debugger.

The company reports that the speed of the compile-edit cycle has been increased by more than a factor of two because the compilation is handled within RAM, and an editor is integrated into the compiler. The editor locates source-code errors by flagging the program and pulling the source code into the editor at that location. When you exit the editor, the program recompiles the code.

Price: \$75.

Contact: Mark Williams Co., 1430 West Wrightwood, Chicago, IL 60614, (312) 472-6659.

Inquiry 610.

BASIC Programming Language for the Atari ST

MichTron has introduced GFA BASIC, a high-level language for the Atari ST. Some of the commands in the program let you incorporate routines from other languages. GFA BASIC has a command that lets you load and execute a non-BASIC Atari ST application from within a BASIC program. Another command calls a routine written and compiled in C. Both commands allow full parameter passing, according to MichTron. Other commands include graphics, UNIX-style DOS functions,

and new keywords.

With GFA BASIC, you can incorporate the features found in GEM, including windows, drop-down menus, and alert boxes. The program also enables you to accept parameters from the main program and use local variables. Line numbers are eliminated with labels in their place, and subroutines have taken the form of procedures.

Price: \$79.95.

Contact: MichTron, 576 South Telegraph, Pontiac, MI 48053, (313) 334-5700.

Inquiry 611.

Programming Know-How in English

The expert-system shell Xi Plus from Expertech enables you to use plain English to create knowledge bases and applications that check and share expert decision know-how. The program is rule based and has extended inferencing, which includes forward, backward, and demon priority rules. Also included are interfaces for external files, graphics, and telecommunications.

The program runs on IBM PCs and compatibles with at least 512K bytes of RAM.

Price: \$1250.

Contact: Expertech, 650 Bair Island Rd., Suite 204, Redwood City, CA 94063, (415) 367-6293.

Inquiry 612.

Virtual Memory Manager

Sapiens V8 is a virtual memory manager for C programmers designed around a least-recently-used 1K paging system. The program emulates an 80386 memory-management system and offers an 8-megabyte workspace.

The program runs on IBM PCs with at least 256K bytes of RAM and MS-DOS or PC-DOS 2.0 or higher.

Price: \$300.

Contact: Sapiens Software Corp., P.O. Box 7720, Santa Cruz, CA 95061-7720, (408) 458-1990.

Inquiry 613.

Debugging with VIM

VIM is an interpreter for 8088 machine code that executes in virtual memory on IBM PCs, XT's, AT's, and compatibles with at least 320K bytes of RAM. The VIM virtual debugging environment includes the addressing space of the processor, so the program under test can work with its own copy of DOS, interrupt vectors, RAM disks, device drivers, and resident utilities.

Price: \$69.

Contact: Digital Dispatch Inc., 1580 Rice Creek Rd., Minneapolis, MN 55432, (612) 571-7400.

Inquiry 614.

Locate Compiler Syntax Errors in QuickBASIC

Bascheck is a compiled artificial intelligence program designed to find compiler syntax problems in files written to run with BASIC interpreters. Written in Prolog, the program writes a printable .ERR file to your hard or floppy disk when it locates illegal compiler syntax and compiler switch requirements. The program supplies line numbers, commands, a statement of the problem, and suggested corrections. The Sieve of Eratosthenes compiled with QuickBASIC and Turbo Pascal are included.

Bascheck runs on IBM PCs and compatibles with PC-DOS or MS-DOS 2.0 or higher.

Price: \$59.95.

Contact: Haines & Associates Inc., 12000 Westheimer, Suite 214, Houston, TX 77077, (713) 493-3149.

Inquiry 615.

Jerry's Best of 1986 Awards

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 Scotts Valley, CA 95066
 (408) 438-8400

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Workman's FTL Modula-2 for the IBM PC and Compatibles... \$49.95
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 1925 East Mountain St.
 Pasadena, CA 91104
 (818) 791-7979

Most for the Money:

Generic CADD \$99.95
 Generic Software
 8763 148th Ave. NE
 Redmond, WA 98052
 (800) 228-3601

Utility:

XenoCopy-PC \$79.95
 Xenosoft
 1454 Sixth St.
 Berkeley, CA 94710
 (415) 525-3113

Word Processing:

WordPerfect
 for IBM PC and compatibles \$495
 for Apple II, IIc, and IIGS \$179
 WordPerfect Corporation
 266 West Center St.
 Orem, UT 84057
 (801) 225-5000

Games:

Starflight for the IBM PC..... \$49.95
 Electronic Arts
 1820 Gateway Dr.
 San Mateo, CA 94404
 (415) 571-7171

StarGlider for the Atari ST.... \$44.95
 Firebird Licensees Inc.
 71 North Franklin Turnpike
 Waldwick, NJ 07463
 (201) 444-5700

HARDWARE

Computer:

Atari 520ST \$999.95
Atari 1040ST..... \$1099.95
 Atari Corporation
 P.O. Box 61657
 Sunnyvale, CA 94089
 (408) 745-2000

Honorable Mention:

Commodore Amiga \$1295
 Commodore Business Machines
 1200 Wilson Dr.
 West Chester, PA 19380
 (215) 431-9100

Most Improved Computer:

Macintosh Plus \$2199
 Apple Computer
 20525 Mariani Ave.
 Cupertino, CA 95014
 (408) 973-2222

Portable Computer:

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 Zenith Data Systems
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 Glenview, IL 60025
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 Fort Collins, CO 80525
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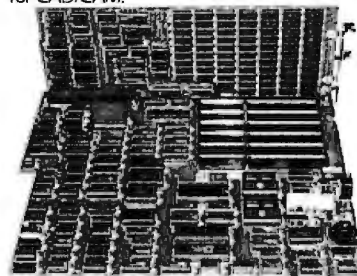
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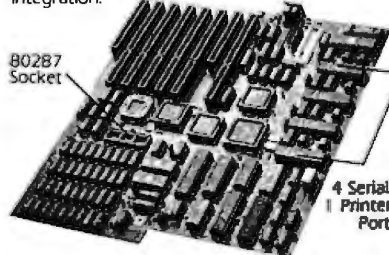
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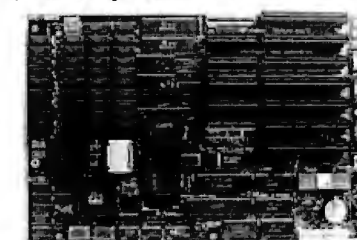
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A Head Full of Cotton

Bruce Webster

Bruce battles the flu while looking at a surprise Christmas present

A new year has started, ushered in by a recurring bout with the latest strain of flu going around. It has left me feeling as though I'm trying to think with a head full of cotton—a condition some friends would argue was normal. The new year has also come accompanied by about 6 inches of snow, a relief to the desperate ski resorts and skiers around the state, but a bit of a disappointment to us regular denizens who were enjoying the clear, dry winter we'd been having so far.

Magic Sac

A package came via Federal Express a few days back. When my son Aaron brought it downstairs to my office, the airbill was missing, so I don't know where it came from. Inside was a set of Mac ROMs (labeled originals, not copies), a Magic Sac package, and a typewritten letter that read:

From: Santa

Ho! Ho! Ho! Your Christmas wish has reached me, and since you've been good this year, the elves and I decided to send you a Magic Sac. Next year, we'll go for a Compaq 386.

Ho! Ho!
Santa.

This is not a cutesy introduction; that letter was actually inside the package, and the airbill was really missing. Anyway, having written about the Magic Sac since I first saw it at the West Coast Computer Faire early in 1986, I was excited to have one of my own to play with.

The package I got contained the new version of Magic Sac, which includes a battery-backed clock/calendar that supports both Magic Sac and TOS (regular Atari) operations. It came with the cartridge itself (2 inches wide by 1 inch high, sticks out about 3½ inches when connected to the ST), an ST-formatted disk with various programs, a Mac-formatted disk with a transfer program, and a cable with a DB-25 connector for the ST modem port and a DB-9 connector for the Mac modem port. As mentioned, you have to supply your own Mac ROMs; only the 64K-byte ones will work, and they must be originals. According to the documentation, the Magic Sac can detect copied ROMs and won't function with them.

Installation was quick, easy, and relatively idiotproof. The manual had extremely detailed instructions on installing the ROMs, inserting the cartridge (which goes into the largely unused cartridge port on the left side of the ST), and booting up the software. I used the MFORMAT program to format some blank 3½-inch disks into what the manual calls "MAGIC format" (400K bytes only).

Since the Atari drives can't currently read Mac-formatted

disks, I had to drag the Mac Plus over by the Atari and use the transfer cable (provided with the Magic Sac). I then ran MRECEIVE on the ST and TRANSFER on the Mac to copy software over. This copies

the disk in the internal drive of the Mac to the MAGIC format disk in drive A of the ST. We're talking slow here, folks: about 12 minutes to do one disk.

Using Magic Sac is almost like using a Mac. The left button on the ST mouse functions as the Mac's mouse button; the other is ignored. The screen is larger, both in real terms and in pixels (640 wide by 400 high, as compared to 512 by 342 on the Mac), and properly written Mac applications can use the extra screen space. The Ctrl key on the ST keyboard is used in place of the Mac's Command key.

There are some work-arounds and rough spots. Since the Mac uses automatic disk eject and the ST uses manual, you must use the Mac method first (click on disk, then select the Eject command or type Ctrl-E), then wait for the letter of the drive (A or B) to flash on the menu bar before manually ejecting the disk. Also, some of the small system fonts (like that used to label icons) aren't as readable on the ST as they are on the Mac.

After I was done, I ran a benchmark program—the same object code I used on the Mac Plus—to see what the results would be. Table 1 tells the story. The Atari ST had a definite edge on performance benchmarks, but the ROM differences between the original 64K-byte ROMs and the current 128K-byte ROMs showed up in just about everything else. The disk I/O benchmarks were drastically different, I suspect because the Magic Sac is working with the worst of both worlds: the old 64K-byte ROMs and System and Finder, and the Atari ST disk drives. (Looking back through my files, I notice that the times are slower than similar benchmarks run on a 512K-byte Mac with the old ROMs.)

You may think this is an unfair comparison, but Apple has been shipping only 128K-byte ROM machines (the Mac Plus and the Mac 512K-E) for quite a few months now; between those and the upgrades, 64K-byte ROM machines are a dying breed. The upshot is that processor-bound applications will run faster on the Magic Sac, whereas, I/O-bound applications—those doing a lot of graphics and/or disk access—will run faster on the Mac Plus and the Mac 512K-E.

By the way, a minor bug surfaced during the benchmarks. The benchmark program I used is self-timing via calls to the

continued

Bruce Webster, a consulting editor for BYTE, can be reached c/o BYTE, P.O. Box 1910, Orem, UT 84057, or on BIX as bwebster.

function TickCount, which returns the number of ticks (sixtieths of a second) that have elapsed since the system was last booted. *Inside Macintosh* warns that this function may be off by a few ticks, but since I time only to 1/10 second, that gives me a slop of ± 3 ticks. However, on the Atari ST, I found that the times reported by the program were significantly longer than the actual time elapsed, by a consistent factor of roughly 1.2. This forced me to go back and retime everything with a stopwatch. Be aware of this if you're writing your own programs for the Magic Sac that use TickCount.

Just after I had everything up and running, my wife Sandra walked into the office. After she had talked to me for a minute or so, I pointed to the ST's screen (which, of course, had the Mac desktop on it) and asked her if she noticed anything interesting. She shook her head and said no. I asked her to look again, and she said it looked just like the other Macintosh. I then pointed out which computer I was using. She did a classic double take and said, "How'd you do that?" (In her defense, I must point out that she also is suffering from the flu.) I explained what the product was, and she replied, "I bet the people at Apple aren't very happy about this."

Ah, there's the rub. While I doubt that John Sculley is losing any sleep over the Magic Sac, Data Pacific has still had to tread carefully to avoid legal action by Apple. The name was changed from MacCartridge to Magic Sac (the software and hardware come inside a stapled brown-paper lunch sack; Dave Small says it's in memory of the surprise packages you once could get at toy stores and carnivals). The manual describes in great detail and with many warnings how to remove the ROMs from your Macintosh, giving no indication of the possibility of getting ROMs any other way. The license agreement states that "... the use of the Magic Sac currently requires the use of software which is the property of others, including Apple Computer, Inc." and that use of it "... will require you to procure the right to use such software from Apple and/or other authorized parties." Betcha the lawyers had fun coming up with the wording on that one. I can just see some end user calling up Apple's legal department and asking for permission to use the Finder and System files on an Atari ST.

This raises an interesting issue: Am I legally limited to using the Finder and System files on a Macintosh? Almost every major Macintosh software package available bundles it with the

Finder and System files, yet a check of several licensing agreements mentioned no limitations as to being able to use that software only on the Macintosh. The same licensing agreements let me make working copies of the master disks (and the manuals usually encourage it). If I have an ST with a Magic Sac and I borrow a friend's Macintosh to transfer over Mac software that I have purchased, all I've done is made working copies, right? I've paid for the software, and I haven't violated any licensing agreements or copyright laws, so is there a problem?

Given the current limitations of the Magic Sac, I don't see it as a major threat to Apple. Software transfer is clumsy, time-consuming, and requires a Macintosh. Data interchange with Macintoshes (except via bulletin boards) is likewise awkward. The current version supports only 400K-byte disks, even if you have double-sided drives. Sound is not supported; but then again, the same is true for owners of Lisas (er, Mac XLs). Hard disk drives are likewise not supported, nor is version 5.0 (or later) of the Finder. Because of the disk transfer process, you can't run copy-protected software. The current version supports only the Atari hi-res monochrome monitor, though late word from Data Pacific indicates that color support has been implemented in-house.

However, many of those limitations may change. The manual hints at future support of the 128K-byte ROM, which would boost performance. This would also lead to support of later versions of the Finder. Likewise, the manual predicts support of 800K-byte floppy disks as well as ST-compatible hard disks. Most important, they mention a forthcoming hardware product that will allow Atari ST disk drives to directly read disks in Macintosh format. That will eliminate the major bottleneck and let users run Mac software without access to a Mac.

In my January column, I gave the Magic Sac an award as the Best Hack of 1986. My opinion hasn't changed at all. And given the large amount of public domain Mac software, you could get by with few purchases of Mac software (you'd need at least one, to get the System and Finder files). At \$149 for the Magic Sac, you can have your ST and Mac it, too.

PAL Expansion Chassis

The Amiga—unlike the original Mac or Atari ST—was designed and built with an open architecture in the form of an expansion bus coming out one side of the computer. Commodore was counting on third-party developers to produce the hardware that would make use of that bus. Unfortunately for Commodore, that hardware was slow in coming, and many of the early products were unreliable or emitted RF signals at levels the FCC found unacceptable. Furthermore, the developers had problems dealing with the bus signals, problems passing them through, problems with power, and problems keeping the cost down (because of all the other problems). All this has served to underscore the lesson that everyone should have learned from the Apple II and the IBM PC: The best open architecture is based on internal slots. Apple, Atari, and Commodore all seem to have now learned that lesson, since official statements and unofficial rumors indicate that the next generation of Macs, STs, and Amigas will have internal slots. So where does that leave those of us with the earlier machines?

Well, those of us with Amigas can look at the PAL expansion chassis, available from Byte-by-Byte at a base price of \$1795. The PAL is about 6 inches high and sits on top of the Amiga, having exactly the same footprint. It connects with the expansion bus through a hardware device called the "staple," a small, thin box (about the size of the Alegra memory box) that plugs into both the Amiga's expansion bus and the PAL's connecting bus. Your monitor then sits on top of the PAL, some 6 inches higher than it was before. I didn't find this bothersome at all—in

continued

Table 1: Benchmarks from the same program run on the Macintosh Plus and on the Atari 1040ST with a Magic Sac. All times are in seconds.

	Mac Plus	Atari ST
Performance:		
sieve	5.9	4.2
matrix mult	6.6	5.6
sort	10.5	7.9
Graphics:		
vertical lines		
offset = 0	12.9	13.1
offset = 1	87.1	174.0
offset = 20	87.1	174.1
offset = 100	86.7	174.4
circles	9.4	17.2
rectangles	17.8	21.8
Input/Output:		
disk write	14.1	56.3
disk read	9.5	12.6
random read	35.7	92.6

fact, it cured my tendency to hunch over the computer—but it might be troublesome to hunt-and-peck typists who have to continually look back and forth between monitor and keyboard.

Inside, the PAL has a heavy-duty power supply, a cooling fan, a battery-backed clock/calendar, and 1 megabyte of RAM. The RAM is located in a section of the Amiga memory map that was originally reserved by Commodore for future use, then was "unreserved." This means that you can still add another 8 megabytes of RAM with expansion cards. Also, the PAL boot disk loads into that memory portions of the operating system that would normally be in "chip RAM," the lower 512K-byte area where all graphics images must reside. This, of course, frees up that memory for graphics data.

For those expansion cards, the PAL has five "Zorro-standard" 100-pin expansion slots. Byte-by-Byte sells a RAM card capable of holding 2 megabytes for \$1195. Other manufacturers are also producing Zorro-compatible cards, though many have complained that Commodore may be changing the standard for future Amiga machines. One nice touch is that the cards can be added or removed without opening up the PAL itself. Instead, the back of the PAL has five small, removable covers—one for each slot. You remove the cover, insert or extract the card, then replace the cover.

The PAL also has room for three half-height mass storage devices, like hard disks. You do, of course, have to open up the PAL to install the device and connect it with its controller card. Byte-by-Byte offers the PAL with either a 20-megabyte hard disk (\$3195) or a 40-megabyte hard disk (\$3995). Byte-by-Byte is also looking at a future potential for CD-ROM devices in those locations.

The PAL I received—for just two weeks (sigh)—came with a 40-megabyte hard disk and a 2-megabyte memory card; list price would have been \$5190. Setup took only a few minutes: Move the monitor off the top of the Amiga; remove the StarBoard II and Alegra memory cards from the expansion bus; put the PAL on top of the Amiga; connect it to the expansion bus with the staple; put the monitor on the PAL; plug the PAL into an outlet; power it up; boot up the Amiga. The PAL came with its own Kickstart and Workbench disks (both version 1.2); the start-up sequence created a Workbench RAM disk.

Table 2: Benchmarks run on an Amiga 1000 with a PAL expansion chassis connected. All times are in seconds.

	RAM disk	PAL hard disk	floppy disk
Disk benchmark (dbench)			
128K file read/write (5x)	53	110	216
512K file write (1x)	22	55	111
512K file read (1x)	21	31	63
Compile and link (Lattice C 3.10)			
dbench (90 lines)	27	47	181
with QUAD: =RAM:	—	40	104
speechtoy (1380 lines)	10	149	535
with QUAD: =RAM:	—	127	256
Compile and link (Aztec C 3.20a)			
dbench	14	23	93
speechtoy	87	108	272
Application work (all from CLI)			
load application (189K)	6	10	32
load picture (39K)	1.3	2.2	4.8
copy app from floppy	18	33	63
copy app to subdirectory	1.5	19	61

The PAL's hard disk, like any other, works faster than floppy disks but slower than a RAM disk, as the benchmarks in table 2 illustrate. As you can see, for most operations the hard disk is only two to three times faster than the floppies. This is due more to performance problems with AmigaDOS than anything else and is not an accurate reflection of the speed of the hardware itself.

Some notes on the benchmarks themselves are in order. The first disk benchmark was a Lattice C routine that repeated the following steps five times: Open a file for output; write out 256 512-byte buffers; close the file; open the same file for input; read in 256 512-byte buffers; close the file. The second routine wrote out 1024 512-byte buffers; the timing did not include either opening or closing the file. The third routine was similar. (Source to all three routines can be found in the ask.webster/benchmarks topic on BIX.)

The application benchmarks were done under the CLI, using Superbase, a new database program for the Amiga. The picture file was loaded from within Superbase. The first copy benchmark was done from df0: to the indicated device (RAM disk, hard disk, floppy disk); the second was done from the device itself to a subdirectory on that same device.

A note on the Lattice C compilation benchmarks: The Lattice C manual recommends that you not assign the logical device QUAD: to the same physical device where your source files are located. However, since I did exactly that for the initial RAM disk and hard disk benchmarks, I also did it for the floppy disk benchmarks. I then ran a second set (for just hard and floppy disk) with QUAD: assigned to RAM:. You can see the difference in performance, especially for the floppy-based compilation. Moral: Listen to what the manual tells you.

The only real disadvantage with the PAL is that it prevents you from using any other hardware that plugs into the expansion bus, since the PAL grabs the bus for itself and does not pass it out anywhere. However, if you don't have an investment in expansion hardware, that's not a problem at all.

Because of costs, the PAL is obviously not for the weak of pocketbook. It's designed and priced for power users, and Byte-by-Byte has had success selling it into engineering and scientific environments. Also, Byte-by-Byte offers a discount to developers; contact them for more details. While I haven't had it long enough to really wring it out, I have had absolutely no problems with it during the period it has been here, and it appears to be a solid, well-built piece of hardware. If you're looking at significantly expanding your Amiga 1000, consider the PAL—especially if you can get someone else to foot the bill.

Product of the Month: Guide

Some years back, Ted Nelson (of *Computer Lib/Dream Machine* fame) pushed the term "hypertext." Regular text proceeds in a start-to-finish flow—essentially one-dimensional. Nelson was referring to multidimensional text, where a given chunk—a word, phrase, sentence, paragraph, page, or document—could be associated with any number of other chunks, each of which could in turn be connected with other chunks, and so on. The associations would extend between documents; browsing through this vast network of items would uncover new relationships and information. Nelson, by the way, has been working ever since then to bring a full-blown hypertext system—Project Xanadu—on-line; for more information, contact XOC Inc., P.O. Box 7213, Menlo Park, CA 94026.

Others have been intrigued by the concept of hypertext, and one company—Owl International—has brought the first hypertext processor to market in Guide. The documents produced by Guide are called Guidelines. A Guideline appears at first glance to be just a regular text file, until you find that with a push of the

continued

mouse button you can expand and shrink text (and/or graphics), jump to related portions of text in that or other documents, and cause pop-up notes and pictures to appear.

The underlying concept of Guide is that of "buttons." A button is a section of text (or graphics) that is connected to some other text (or graphics). A button could be a single character, a word, a sentence, a picture—in short, any part of your document that you can select by dragging your mouse. The three types of buttons are replacements (including inquiries), references, and notes. Buttons are not visible within the text; your document looks normal. However, the aspect of the button text is changed, and when you move the cursor over a button, it (the cursor) changes shape, the new shape reflecting what type of button is beneath. If you then click the cursor, you trigger that button.

A replacement button is indicated by boldface text; when you move the cursor over it, the cursor changes to a circle with cross hairs. When you click the mouse, you replace the buttoned text (graphics, etc.) with different text, graphics, and/or buttons. A typical use is to replace a brief comment or description with longer, more detailed text. Note that you can continue to browse in the text before and after the expanded section, just as you can activate buttons elsewhere and then scroll back to this section and still see the replacement text. If you move the cursor within the replacement text and click the mouse, it (the replacement text) disappears and the original text is back in place.

An inquiry is actually a collection of replacement buttons that are mutually exclusive. In other words, an inquiry might have

four replacement buttons; if you choose any one of them, it and the other three are all replaced by that one button's replacement text.

A reference button is indicated by italicized text; the cursor changes to a fat arrow pointing to the right. When you click the mouse, the button doesn't replace or expand text. Instead, it moves you to another portion of your document or even to another document entirely. As with the replacement button, you can get back to where you came from by clicking on the reference text. Or you can click on the special backtrack icon at the top of the vertical scroll bar. Note, however, that you can back up only through 32 references, so if you've wandered too far afield, you may have to go directly back by closing and opening files.

A note button is flagged by underlined text; the cursor changes to a fat asterisk. It pops up a small chunk of text and/or graphics while you hold the button down, analogous to the ubiquitous yellow Post-it notes. Unlike the previous two buttons, the text (which is in its own window) goes away as soon as you release the mouse button.

What if you've selected a number of replacement and reference buttons, and you want to quickly back up to your original document? One command, Top Level, will take you all the way back. And while buttons are not normally visible throughout the text, you can select the Show Symbols command, which will bracket each button in the text with symbols indicating which type of button it is.

Creating a Guideline is straightforward. You enter text just as you would with a word processor. When you want to create a button, you select the text for that button with the mouse, just as you would select text to be cut or copied. You then go to the Make menu and select the appropriate command. You can open other files to grab text (or graphics) to paste in or to create reference links. You can create any number of buttons within a button, and you can nest buttons to an unlimited depth. The actual details are specific to each button but are easily learned, thanks to the manual and example files.

Speaking of which, the manual is very well done, even by Macintosh standards. The first 70 pages or so form a tutorial that does an excellent job of teaching you how to use Guide. The next 60 pages are a user's guide, and the last 60 explain each of the commands in detail. Guide comes on two disks with lots of example files and is not copy-protected.

The Guide disks include MiniGuide, a desk accessory version that lets you open and read Guidelines while within other applications. One possible use of MiniGuide is to create custom help files for certain applications to allow on-line help for those less familiar with how to use those programs. Also included is a Calendar Kit. This contains a template of a single month, where each date is a reference button. By clicking on a given date, you go to an appointment calendar for that specific day. By copying this file and then changing it to a specific month, you can create your own appointment book.

How useful do I think Guide is? It's hard to say because I am so used to thinking in a linear paper-and-pencil format, and I'm not yet skilled at creating and using Guidelines. The feeling, though, reminds me of when I first learned Pascal, some seven years ago. Prior to that time, I had done most of my high-level coding in FORTRAN, which has just one real data structure: the array. In FORTRAN, you build everything out of arrays, and I had gotten very good at doing just that. Now I was confronted with the freedom to define my own data structures: arrays, records, sets, enumerated data types, subranges, strings, and so on. I felt unsure of myself, and it took me some months to become confident of my own ability to create the right data structures. Now—some 100,000 lines of Pascal later—I take that as a

continued

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(416) 881-9941

Guide \$134.95
Owl International Inc.
14218 Northeast 21st St.
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(206) 747-3203

Lattice Amiga C Compiler \$225 or \$375
Lattice Inc.
P.O. Box 3072
Glen Ellyn, IL 60138
(312) 858-7950

Magic Sac \$149
Data Pacific Inc.
609 East Speer Blvd.
Denver, CO 90203-4240
(303) 733-8158

PAL Expansion Chassis \$1795
with 20-megabyte hard disk \$3195
with 40-megabyte hard disk \$3995
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Byte-by-Byte
Arboretum Plaza II, Suite 150
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**ACCORDING TO WEBSTER**

Guide proves the contention that the best software being developed is on the Macintosh.

matter of course; were I to go back to FORTRAN, I'd probably feel terribly constrained. I suspect that if I use Guide long enough, the same thing may happen: Word and outline processors will feel limited.

Guide easily earns its award as product of the month on three different counts: innovative application, excellent software (I have yet to run across a single bug), and high-quality documentation. It is proof of the contention made by my friend Frank Boosman that the best, most innovative software being developed today is being done on the Macintosh.

Notes and Updates

Batteries Included has released a new version of Tom Hudson's excellent paint program DEGAS, called DEGAS Elite. Like its predecessor, DEGAS Elite runs on the Atari ST with either a color or monochrome monitor. Unlike its predecessor, it allows you to have multiple pictures open simultaneously; lets you draw basic shapes (circle, line, etc.) by setting two points; does scaling, flipping, rotating, and 10 levels of magnification; and has lots of other nifty new things. Best of all, it's only \$79.95. If that's too rich for your pocketbook, you can buy the original DEGAS for \$39.95. And, of course, neither is copy-protected. If you own an Atari ST, you should own either DEGAS or DEGAS Elite—it's that simple.

Lattice has also released version 3.10 of their C compiler for the Amiga. Improvements include rewritten documentation, elimination of numerous bugs, support for version 1.2 of the Amiga system software, and substitution of BLINK for ALINK. ALINK is the original Amiga linker and is notorious for being both big and slow. BLINK, developed by the folks at The Software Distillery, is a great improvement. Also, the Lattice Text Management Utilities are now bundled in. The result of all these improvements is that I have now switched back to Lattice C for my Amiga development, mostly because I find it easier to get my applications up and running using it. Off the shelf, it costs \$225. There is also a Professional Package that includes all of the above plus the Lattice Screen Editor, Make Utilities, and (best of all) the Metascope Debugger for \$375—a good deal.

The Hackers Corner

BLINK, mentioned previously, is a public domain linker for the Amiga developed by a group of Amiga hackers known collectively as The Software Distillery (235 Trillingham Lane, Cary, NC 27511, (919) 469-4210). Said programmers have developed several other programs for the Amiga, including POPCLI, a utility that lets you bring up a new CLI window from within any application and blanks your screen after a certain amount of time elapses with no user input. They have also produced HACK, a graphics version of the old UN*X dungeon game. All of these are public domain and can be downloaded from The Software Distillery BBS, which is at (919) 471-6436. If you don't have a modem, they can send you the software on a disk; write or call to find out what the current costs are.

In the Queue

Next month will include a report on the MacWorld Exposition, a look at the Radius FPD (Full Page Display) for the Mac, and the usual odds and ends. Until then, I'll see you on the bit stream. ■

course, and probably will stop being a problem very soon as more and more people pick up V1.2)

ATARI ST

This month's Atari sections starts off with a thread on the strange case of "re-rebooting," which finishes with some thoughts on the length of time required between power-off and power-on. Next is a thread on C-Shell command-line problems, and we finish up with two short (though related) threads on trackballs, mice, and joysticks.

RE-REBOOTING PROBLEMS

atari.st/main #1601, from tjefries (Tom Jeffries), Fri Jan 23 01:52:42 1987.

There has been some discussion on BIX of the ST's restarting the boot procedure after getting nearly finished. I discovered something that may be coincidental and is silly enough that I hesitate to bring it up, but I would be curious to see if this is the answer, and the only way to find out is to have several people try this "fix."

Recently, my screen display started flickering. This has happened before and I have been told that sooner or later I would need some new chips. I remembered, though, that I had been switching monitors a lot recently, so I tried pushing the monitor plug in a little harder. The flicker was gone.

Another thing that was gone, though, was the re-rebooting problem, which had been getting fairly bad (once out of every two or three times). I have not had the problem reoccur in the last 8 or 10 hours of work.

Is the solution really this simple? It certainly could be that if the OS doesn't see a monitor, it will reboot. I'm not sure why the reboot occurs when it does. Is the interrupt that checks the monitor shut off during disk I/O?

If you have been plagued with this problem, try pushing the monitor connector in as hard as you can without breaking anything. Post a note here with the results.

atari.st/main #1602, from dsmall (David Small), Fri Jan 23 01:54:20 1987. A comment to message 1601.

Sure, the monitor connector will generate a high-priority MFP interrupt if it gets loose. Having that jiggle is singularly bad karma - in fact, last time I trashed my hard disk, that was why.

atari.st/main #1605, from alex (Alexander Pournelle, Workman & Associates), Fri Jan 23 02:04:42 1987. A comment to message 1602.

Hmm, I thought that was the PLI: Product Liability Interrupt. It shut down the ST before it croaked a monitor, so. . .

atari.st/main #1609, from blevine (Robert Levine), Fri Jan 23 21:26:50 1987. A comment to message 1601.

Glad to know I'm not the only one with the re-rebooting problem. I don't have any flicker on the monitor so I can't confirm your observation. However, my monitor connector has a loose fit and I keep moving the ST around the desk to get a more comfortable position for the keyboard. So I wouldn't be surprised if that contributed to the problem.

I'm pretty sure that mouse movements during the boot phase will sometimes cause the re-reboot, but not always. I did some

experiments where I booted repeatedly off a disk with no AUTO folder and no accessories (in order to keep things as simple as possible) and mousing around appears to be a no-no.

I'm also thinking that you need to give the ST a good rest when you turn the power-off and on for a cold boot.

atari.st/main #1612, from tjefries, Fri Jan 23 23:29:11 1987. A comment to message 1609.

As far as I can tell, waiting less than 10 seconds on a power-off is asking for trouble; knowledgeable people have recommended 15.

atari.st/main #1613, from jtittsler (Jim Tittsler, Atari Corp.), Sat Jan 24 01:41:00 1987. A comment to message 1612.

The necessary off-time varies between the 520 (where you are switching the +5V supply) and the 1040 (where you are switching the AC line). A second or two will work with the 520 . . . but 10 seconds or so is probably more appropriate for the 1040.

atari.st/main #1615, from tjefries, Sat Jan 24 02:06:26 1987. A comment to message 1613.

Actually, I have an upgraded 520. I bought it before the 1040s were out. Seems to take more than a second or two, but maybe mine just has especially retentive memory chips (small chuckle).

atari.st/main #1624, from dsmall, Mon Jan 26 22:06:33 1987. A comment to message 1613.

A better way is to put a short assembler routine into your AUTO folder that zaps the memory-valid flags. Then, anytime you RESET, you force a system coldstart.

Just check out the BIOS variable list for the two .longs to zap.

C-SHELL CAUTIONS

atari.st/main #1630, from sprung (Ron Sprung), Thu Jan 29 00:46:27 1987.

This just cost me two hours of real sweat, folks. I have a copy program that I use from my shell. I'd finished a day's work, and went to back up the files I'd worked on during the day. I happened to be in C-Shell, so typed

```
copy prtsedit.* \a:
```

then, to my horror, saw:

```
prtsedit.prg -> prtsedit.mod
```

I'd forgotten that C-Shell expands the command line before giving it to the called program. (Sigh.) On the plus side, I did the work better the second time.

The point is, when using a shell that expands the command line, use considerable caution with utilities not supplied with the shell. I think this convinces me to be against command-line expansion by shells.

atari.st/main #1631, from jim_kent (Jim Kent), Thu Jan 29 01:09:59 1987. A comment to message 1630.

Also, it shows the value of a text editor that saves your last version in, say, prtsedit.bak. . . . Many a slip 'tween the fingers and the chip. . . .

continued

atari.st/main #1632, from sprung, Thu Jan 29 15:32:36 1987. A comment to message 1631.

Agreed - I have always preferred for editors to rename the read version to .bak when saving the edited version. ConTEXT does that; EMACS does not. Maybe the next version of ConTEXT will be neat enough to make me switch for good.

atari.st/main #1637, from alexl. (Alex Leavens), Fri Jan 30 05:39:36 1987. A comment to message 1632.

Ron, here's a cute little shell script that will back up your source file, and then run EMACS on it. . . (Assumes the source file is a .C file. . .):

```
#
# MEDIT.SH Back up source file, then edit it using MicroEMACS
#

cp $1.c $1.bak
edit $1.c
```

atari.st/main #1639, from sprung, Fri Jan 30 12:07:43 1987. A comment to message 1637.

If I worked from the C-Shell, I'd probably do just that. Guess I need to add some capabilities to my menu shell. It is cute though.

atari.st/main #1640, from tjeffries, Fri Jan 30 13:01:59 1987. A comment to message 1637.

Alex, how would you feel about sharing your technique for enlarging the image on the monochrome monitor?

atari.st/main #1636, from alexl., Fri Jan 30 05:38:00 1987. A comment to message 1630.

I wrote my own command script, called COPY.SH, which explicitly searches through the command line and sucks out the CORRECT directory/pathname, and then passes the copy commands as appropriate to the copy utility, just to avoid such a problem. If you're interested, here it is. . .

```
#
# COPY.SH
#
# copies things from current directory to \newdirectory
#
#

foreach i ($*)
  set directory = $i
end

foreach i ($*)
  if ($i == $0) then
    continue

  else if ($i == to) then
    continue

  else if ($i == $directory) then
    continue

  else if (-e $directory \ $i) then
    echo "File $i already exists in $directory \, overwrite it
(y or n)?"
    set a = $<
    if ($a == y) then
      cp $i $directory \ $i
      echo "----file $i overwritten in $directory \ "
    endif
  else
```

```
cp $i $directory \ $i
echo "----file $i copied to $directory \ "
endif
```

end

#Note: This only works with Dave Beckemeyer's C-Shell. . .

USING A TRACKBALL. . .

atari.st/tech #1509, from jimomura (Jim Omura), Wed Jan 7 00:11:18 1987.

I tried hooking up my Atari trackball to the 1040ST. It won't work in the Mouse port, regardless of the setting (Trackball or Joystick). It works in the Joystick port in the Joystick setting. Funny thing is that although Joust is very nice with the trackball, Time Bandit suffers terribly. Not what I would have expected at all.

atari.st/tech #1550, from jtittsler, Fri Jan 16 03:18:19 1987. A comment to message 1509.

As you mentioned in your message, (one of the two versions of) the Atari trackball can be switched between Trackball and Joystick modes. When in Joystick mode, it detects motion of the ball and generates the corresponding joystick "switch closure."

In Trackball mode, rather than providing the quadrature-phase signals that the IKBD is expecting, the unit provides a "direction" and a "velocity" signal for each axis. The velocity signal is a pulse train that corresponds to the ball rotation. I can think of two ways of using the trackball: 1) Write some software. Put the IKBD in joystick mode and in a custom ISR (interrupt service routine) fake mouse input. This is probably not a good idea because of the number of interrupts you will get in this manner. 2) Modify your trackball. Ignore all of the clever circuitry inside the trackball, and go back to the quadrature signals produced by the optical interrupters on the bearings that the ball rides on.

. . . AND A JOYSTICK

atari.st/tech #1578, from ddenhart (David Denhart), Thu Jan 22 11:49:41 1987.

I need help using the joystick on the ST. The problem is that the operating system is interpreting the joystick button as the right mouse button and calling my mouse server (which I set up using INITMOUSE). I have no problems with the mouse or joystick movement, just the button. Any suggestions?

atari.st/tech #1580, from jtittsler, Fri Jan 23 02:23:21 1987. A comment to message 1578.

The button on joystick1 and the right mouse button are the same (in hardware) as far as the IKBD controller knows. The interpretation of the button is based upon the mode you put the IKBD in. Requesting any of the mouse modes (relative, absolute, or cursor) will make the two buttons logically part of the mouse. A joystick-mode command will make both ports look like joystick ports and logically separates the two buttons.

If you want to use both the mouse and a joystick, you will have to avoid using the right mouse button, and use the software of your mouse ISR to pick off the right button state.

atari.st/tech #1581, from dsmall, Mon Jan 26 22:13:15 1987. A comment to message 1580.

Alexl. tells me that trying to boot the system with a joystick

continued

connected makes it fizzle. I can't remember the exact details, but it was definitely voodoo time.

atari.st/tech #1583, from jtittsler, Mon Jan 26 22:54:45 1987. A comment to message 1581.

That sure sounds like voodoo, since an at-rest joystick is all open switches, so if the system can tell it is there, it is doing okay!

atari.st/tech #1585, from alexl., Tue Jan 27 06:04:02 1987. A comment to message 1581.

Early versions of the keyboard had a problem with simultaneous joystick/keyboard entries. If the joystick was on, the keyboard would get lunched. This isn't normally a problem, but see, my joystick had fallen behind my desk, and was on, and I had forgotten it was connected, and. . . <grin>

atari.st/tech #1584, from mmanlove (Mike Manlove), Mon Jan 26 23:18:29 1987. A comment to message 1583.

I tried booting with a joystick in mouse port 0 once. Didn't work worth beans, but it didn't crash, either.

atari.st/tech #1586, from alexl., Tue Jan 27 06:04:45 1987. A comment to message 1583.

This joystick wasn't at rest. (It had fallen behind the desk on its side. . . .)

IBM PC and Compatibles

When is an error not an error? That's the discussion of the first thread of this month's IBM section. It's followed by two long threads that show how discussions progress (and digress) on BIX. The first is everything you ever wanted to know about reset switches. The final thread starts out with a discussion of PATHs but quickly goes into "Trojan horse" programs before returning to the business at hand.

AN ERROR THAT'S NOT

ibm.pc/hardware #2018, from bernie.g (Bernie Gallagher), Sat Jan 3 14:07:47 1987.

The other day, out of curiosity, I ran the diagnostics diskette that came with my PC XT. About halfway through, it came up with the following error message:

```
SYSTEM UNIT 600
0:04:19
ERROR - SYSTEM UNIT 1302
```

I have had my computer for nearly a year now and have had no problems with it. I can't find in the "Guide to Operations" what this error message means, either. Is this a mere "routine" error message, or should I bring in my PC for service? By the way, the diagnostics are version 2.07.

ibm.pc/hardware #2020, from pfletcher (Peter Fletcher), Sat Jan 3 16:04:35 1987. A comment to message 2018.

I bet you had a modem connected to your serial port and powered up. The diagnostics are telling you (in their own inimitable way) that one of the handshaking lines on the serial port is pulled high (or low). Try again after physically disconnecting your modem.

ibm.pc/hardware #2024, from bernie.g, Sat Jan 3 19:21:15 1987. A comment to message 2020.

You mean that I got that diagnostic error message just because I have a modem (namely, IBM's own internal 1200-baud PC modem) inside my PC?! Well, I'll try removing the modem and rerunning the diagnostics, but if the message goes away, does that mean there's something wrong with the modem (which is about 6 months old and has had plenty of use since I started running my own BBS without any problems)?

ibm.pc/hardware #2023, from rfm (Rich McAllister), Sat Jan 3 19:05:10 1987. A comment to message 2018.

My "Guide to Operations" and "Hardware Maintenance and Service" books show 13xx as Game Control (Joystick) Adapter problems. Do you have a game control adapter (say, on a multifunction card)? Have you ever used it?

ibm.pc/hardware #2025, from bernie.g, Sat Jan 3 19:33:17 1987. A comment to message 2023.

Your explanation sounds more logical than the modem. I have the IBM game control adapter, which the store threw in as a freebie when I bought my PC and I have used it on rare occasions to play Flight Simulator. Aside from crashing into Lake Michigan every time I've tried playing it, it seems to be working correctly, although it has, otherwise, had very little use.

ibm.pc/hardware #2027, from pfletcher, Sat Jan 3 19:43:10 1987. A comment to message 2024.

Ignore my previous comment. Serial-port errors are 11xx, not 13xx. It shows how long it has been since I ran my diagnostics. However, if you do get an 11xx error when a modem is connected, it does not mean that ANYTHING is defective - simply that the modem is holding one of the handshaking control lines in a state other than its default (open-circuit) state. You will also usually not see them from INTERNAL modems - only external ones attached to a "real" serial port. As someone else has noted, 13xx errors come from the game port - perhaps you have such a port but your joystick was not connected or your multifunction card hasn't got one but is jumpered as if it had. Sorry for the confusion.

ibm.pc/hardware #2131, from bernie.g, Sat Jan 10 14:14:06 1987. A comment to message 2023.

Yup, that was the problem. I removed the joystick adapter and the diagnostics gave my machine a clean bill of health! Thanks.

THE WORD ON RESET SWITCHES

ibm.pc/hardware #2048, from Ikolakowski (Lee Kolakowski), Sun Jan 4 13:00:10 1987.

In a publication awhile ago they gave instructions on how to add a reset button to your PC. The one thing that was not clear was whether this fix allowed you to bypass the POST routines when a hard boot is required. Any experiences?

ibm.pc/hardware #2049, from jfleming (Jon Fleming), Sun Jan 4 14:00:08 1987. A comment to message 2048.

It pulls one line low for a moment and forces a reset. It is not supposed to bypass the POST, but rather be just like the big red switch without any power spikes. My experience is that the POST will be skipped maybe 20% of the time, especially if you blip the switch real quick.

continued

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The chips in the set are called the 43201 (CPU), 43202 (MMU), and the 43203 bus interface.

I do not know of any commercial computer system using the iAPX432, and I am not aware of any operating systems for it, either.

You can call Intel at (914) 297-6161 in Wappingers Falls, New York, for additional information.—Steve

Expanding a Clone

Dear Steve:

I recently purchased a cabinet, eight-slot backplane, and power supply to make an expansion box for my IBM clone. When I hooked the clone's bus directly to the backplane with a ribbon cable, however, my computer would not even display the monitor prompt.

Do you have any suggestions on how to hook the new backplane and power supply to the clone's bus?

Ed Cabler
Port Ludlow, WA

The IBM Hardware Technical Reference Manual shows one way to connect an expansion unit. The description is in Chapter 1 under "Expansion Unit." They use a driver card in the main unit expansion bus, a receiver card in the expansion box, and a shielded cable that carries all bus signals except OSC (the clock). The expansion box has its own power supply and clock oscillator, and a wait state is inserted to allow for lack of synchronism between the main and expansion unit clocks.

Logic diagrams, which are almost complete schematics, are also included in the Technical Reference Manual's Appendix D.

This is not the only way to interface the units. If you use a very short cable, are very careful about noise, and use proper termination, you might be able to carry all the signals.

A card with a set of buffers on each end may also work, but your experience shows why IBM suggests a driver/receiver card combination.—Steve

Atari and IBM Interface

Dear Steve:

As a user, I am tempted by all sorts of hardware currently on the market. One of the things that I've been considering is a new toy, something like an Atari ST or an Amiga, capable of nice graphics and at a reasonable price. On the other hand, IBM and its clones, with their marvelous outpouring of software packages, are threatening to seduce me away from my thousands of dollars worth of CP/M equipment.

I imagine I can take the plunge, buy

two more machines, and retire my favorite S-100 equipment to a closet to make room. But the biggest problem with two or more machines is where to put the keyboards and monitors.

Would it be possible to build an interface board to stick into an IBM to translate input from the foreign keyboard of an Atari ST (or Amiga) to run IBM programs, and then translate output to use the Atari's monochrome and/or color display?

If such a board allowed the Atari to use the IBM's RAM memory and floppy and hard disk storage, interchange Atari and IBM data at will, and run most IBM software when operated as a terminal program, I would scurry out and buy one today. It would solve the problems of desk space, expanded memory for the Atari (or Amiga) graphics, lack of top-notch graphics for the IBM, and laser-printer graphics output. And besides, with a terminal program I could keep at least one S-100 on the same desktop, like an old friend to commune with about the folly of the younger generation.

C. M. Kotlan
O'Brien, OR

It is fairly easy to use a computer as a terminal to run an IBM PC. PC-DOS has features to allow this, and there is one software system that I know of that allows remote running of one IBM from another. As far as I know, however, this software does not have a version that will link IBMs with non-MS-DOS computers.

The simplest method would be to use an IBM, Amiga, or Atari as a "dumb" terminal to run your S-100 system. I'm guessing that you do little or no graphics on the system, so a straight-ASCII serial (RS-232C) interface is adequate.

The basic communication between computers is fairly easy as long as all data is ASCII, and the PC can be set up to accept commands from and redirect text output to the serial port.

Generally, however, the type of interface you are seeking is either very difficult or impossible to construct. It might be possible to write software to run on an IBM PC so that output would be sent to an Amiga or an Atari ST to be displayed in graphics form, but there is no practical way to make commercial software for the IBM PC send graphics output to either computer.

Direct use of a remote computer's memory as expansion memory is also generally not possible. Programs are written to access memory directly in a random fashion, with data being taken sequentially only in short segments. Using a remote computer as storage for

continued

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large programs would be like having most of the program on disk, and paging sections in and out as needed would be slow.—Steve

CIRCUIT CELLAR FEEDBACK

Expanding a Kaypro

Dear Steve:

Since coming across your Circuit Cellar articles on the SB180, I am very intrigued by the possibilities offered by the HD64180 chip. I have a Kaypro 1, which I use primarily for word processing with WordStar. I am very pleased with the Kaypro, but I would like to enhance it, particularly by speeding it up and adding a RAM disk. The HD64180 seems like just the answer, and your design of the SB180 in combination with the Z-System seems to be what I am looking for.

Southern Pacific offers an HD64180 board for the Kaypros, but it uses CP/M Plus rather than the Z-System, and your account of the capabilities of the Z-System have sold me on it. I wonder if the Z-System can be used with a board other than the SB180?

My only regret about the SB180 is that it doesn't use the full 512K RAM that the chip is capable of addressing, but I can see that it would take a larger board to accommodate the added memory chips.

Wendell J. Fay
San Diego, CA

I am not familiar with the Southern Pacific HD64180 board for the Kaypro, but I do know that Echelon, Inc., the company that wrote ZCPR3 and the rest of the Z-System software, does have versions available for many computers other than the SB180. Their address and phone number are:

Echelon Inc.
885 N. San Antonio Rd.
Los Altos, CA 94022
(415) 948-3820

A newer, more powerful version of the SB180 is now available. Called the SB180FX, it supports a larger RAM disk (up to 4 megabytes with a new memory expansion card) and has a SCSI hard disk interface on the main circuit board.—Steve

Graphics and MIDI

Dear Steve:

Do you know of a graphics chip I can use to produce a 256- by 256-pixel black-and-white display? Each horizontal line would require 32 bytes, so that 256 rows would amount to 8K bytes of RAM.

Also, I am interested in MIDI; what register and crystal values would let the Z8671 microcontroller's serial I/O port run at MIDI's 31.25K bps? Any input you can offer would be appreciated.

Matthew Taylor
Austin, TX

My GT180 graphics board, which appears in the November 1986 issue of BYTE, describes the application of the Hitachi HD63484 Advanced CRT Controller chip. This system would give you a high-quality, high-resolution color display. Other graphics chips that are suitable include the Motorola 6845 and 6847.

There is no single-chip graphics system, although the NEC 7220 will put a full graphics system together with a minimum of parts. A shift register, the RAMs, a RAM timing generator, and a video sync mixer are all that it requires.

For the Z8671, use an 8-MHz crystal. Set the prescaler for the T0 timer to 1, then set the counter to divide by 4, and the UART section divides by 16 to give 31.25K bps. The chip divides the clock frequency by 4.

I think you might have some trouble running a synthesizer with this chip in interpreted BASIC, however. If you are just going to use it to upload and download waveforms and control one voice it should work, but it would probably be too slow to handle several voices and a keyboard.—Steve

Striking Out Alone

Dear Steve:

I have recently been considering starting a custom programming business. As a result, I would like to obtain some information that could help educate me on all of the trials and tribulations that would be in store for me, as well as give me hints on streamlining such an operation.

Roy Anderson
Long Beach, CA

The first principle of consulting (that's what you're getting into, even though you may think of it as custom programming) is that free advice is worth every penny you pay for it.

I have to make a few assumptions:

- You are starting out as a one-man operation.
- You are pretty competent at writing code.
- You have a moderate amount of get-up-and-go.

Getting started is easy: You need a telephone answering machine, a supply of
continued

First, I assume that the RAM is checked for by writing to those locations and reading back to verify. Is the original data replaced (i.e., does it do a read before the first write and, if RAM exists, replace the data)? I'm wondering about recoverable RAM disks surviving the AutoConfig. Second, what is the "legality" of using this address space for RAM? If I build myself a 1.5-Mb card to sit on the expansion bus, am I going to run into any problems down the road with someone else's product wanting this address space? How about my RAM getting along with Auto-Configured RAM and other devices?

Oh, why does 1.2 AutoConfig this space? Was it really intended for RAM?

amiga/hardware #1129, from grr, Wed Feb 18 02:52:27 1987. A comment to message 1128.

Actually, it works the other way - it starts at C0 and scans upwards until it sniffs at something that looks like the Amiga custom-chip registers.

One word every 64K or so will get popped, so unless your RRD expects this, you're out of luck.

The exact intent of this RAM allocation is no longer clear. It does provide a non-Auto-Config expansion, so perhaps the original allocation predates a final Auto-Config proposal.

The rub is that it overlays the area allocated to the custom-chip registers. The worst case timings involved give no slack for decoding and asserting OVR to inhibit the custom-chip cycles. Boards with built-in expansion RAM decode the C0-D8 space explicitly and are spared this problem.

The Auto-Config stuff is really not that complicated; you might want to consider it, rather than making something potentially flakey.

amiga/hardware #1132, from jsan (Jez San), Wed Feb 18 07:51:44 1987. A comment to message 1129.

Rather than losing one word every 64K, why not save the word that was there before you test that it's valid RAM, and then restore its contents so the RRDs don't get choked!

amiga/hardware #1134, from jdow, Wed Feb 18 13:25:18 1987. A comment to message 1132.

Because someone didn't think of that at the time the "memory test" was designed. That's a real bummer.

amiga/hardware #1130, from jdow, Wed Feb 18 04:07:23 1987. A comment to message 1128.

Like OOPS! That is a possible BAD issue on RRDs. I may have to limit allocations to below that.

amiga/hardware #1131, from grr, Wed Feb 18 05:05:48 1987. A comment to message 1130.

Also, AmigaDOS will load itself up there instead of chewing up chip memory.

amiga/hardware #1133, from afinkel, Wed Feb 18 10:04:55 1987. A comment to message 1131.

With the current V1.2 Kickstart, one word in each 64K gets trashed if it's RAM. This will mess up an RRD. Except for ExecBase, I think (using the normal Amiga memory-allocation stuff) that memory will be used after any other fast RAM. Perry's RRD does something like allocate from the top, right? So, if he stays out of C00000, all will be well, as the test for Auto-

Config memory is nondestructive. An RRD that allocates from the bottom will tend to work anyway if you have Auto-Config fast RAM as well as C00000 RAM (you'd have to have a really large RAM disk to make it fail, anyway). Yes, it would have been nice if the C00000 memory check was nondestructive. Maybe next revision.

amiga/hardware #1135, from jdow, Wed Feb 18 13:29:32 1987. A comment to message 1133.

Er, how would you propose to allocate from the bottom without risking having the boot procedures clobber it? That sounds like a VERY risky proposition. It really sounds like the best bet is to limit the allocation algorithm to allocating from the top of the original 8-meg expansion area down. I had mine intentionally planned to limit itself to within the 24-bit standard Amiga address area because I don't want to use up a resource like 32-bit-wide turbo RAM with a RAM disk. I can easily change the test constant. I'm glad, though, that I was warned.

amiga/hardware #1136, from steveth, Wed Feb 18 22:20:45 1987. A comment to message 1133.

Wait a sec. I think that all of this RAM trashing doesn't make any difference, unless I'm mistaken. I assume that the routine that checks for extra chip RAM (\$080000-\$1FFFFFFF) is the same one that checks for fast RAM (\$C00000-\$D7FFFF). Now, if this is true, then data will not be stomped. The reasoning behind this assumption is that one of the ways to fix the 512K internal modification that is located at \$080000 is to keep the RAM from being enabled until after the location has been checked for RAM. This is accomplished by monitoring the LED of DFO: . The circuit watches for a prolonged period of the LED being turned on, such as during the loading of Kickstart. After the LED goes out, the next time it comes on triggers the circuit to turn on the RAM, and the circuit locks in that mode until power-down. Finally, to the point: The circuit does not reengage on a warm boot (it wouldn't work anyway, as Kickstart isn't reloaded), and the system doesn't configure the RAM as chip RAM again. This seems to indicate that the testing for these RAM areas is NOT done on a warm boot! It would be done if you changed operating systems, as with the ChangeKick program, but I don't think anybody expects an RRD to survive THAT.

This is all coming off the top of my head, but it makes sense, doesn't it?

amiga/hardware #1137, from grr, Wed Feb 18 23:09:04 1987. A comment to message 1136.

The routine that checks for C0 RAM is specific to that purpose. It will mash a word in each increment. I think this will only happen when you reset the machine, but I'm not sure.

amiga/hardware #1140, from perry (Perry Kivolowitz), Fri Feb 20 16:43:03 1987. A comment to message 1136.

The recoverable RAM disk has been known to survive ChangeKick.

ATARI ST

The trials and tribulations of creating a program that writes IBM PC-compatible text files on a floppy disk starts out this month's Atari section. Next is a discussion of a strange bug in an early version of ST BASIC. Then, there's a thread in which BIXen discuss whether it's better to leave hard disks going all the time or to turn them off.

continued

CREATING IBM PC-COMPATIBLE TEXT FILES

atari.st/questions #868, from mhadley (Michael Hadley), Sun Feb 1 05:22:20 1987.

Question: I am new here and I'm trying to write a fairly simple program, a short routine in assembler that allows me to use a 5 1/4-inch disk drive with a 6-millisecond step rate to create IBM text files. I am using a 1040ST and an M.C.C. Macro Assembler.

I know I need to be in the supervisor mode to write to the protected memory (to change Seekrate (\$0440) or to insert the routine into the VBL queue (\$04CE++)), but when I use any of the routines in GEM, BIOS, or the XBIOS, I get bombs. The locations in protected memory remain unaffected in spite of all my efforts to change them.

Here are a few questions for discussion:

- 1) What am I missing in all this information? This problem really has me bugged because I cannot get into the supervisor mode, no matter what I have tried so far.
- 2) Is there a SURE way to get into the supervisor mode (and out as well) that is not documented (apparently in error)?
- 3) Has someone already hacked this problem and is the solution available to us mortals?

atari.st/questions #869, from tskinner (Thomas Skinner), Sun Feb 1 14:30:00 1987. A comment to message 868.

I have used the GEMDOS Super function 0x20 with no problems. Are you using this or the BIOS call? It is difficult to know what

you are doing wrong without seeing your code. The GEMDOS call is a bit tricky to use so read about it carefully. How many bombs are you getting? That tells you what the exception was.

atari.st/questions #870, from jtittsler (Jim Tittsler, Atari Corp.), Sun Feb 1 16:50:55 1987. A comment to message 868.

It should also be pointed out that just changing Seekrate (\$0440) is NOT enough to change the CURRENT floppy seek rate.

David Small suggested one way of changing the seek rate in atari.st/questions #767, but you should be aware that since he is using undocumented variables there is an EXCELLENT chance that this scheme will not work with future versions of TOS.

atari.st/questions #872, from dsmall (David Small), Mon Feb 2 22:27:08 1987. A comment to message 870.

"Using undocumented variables" is really an apt way to describe my life history. . . .heh.

Try setting \$A08.W and \$A0C.W to \$00 from \$03; that will slow down the seek rate. Basically, the seek rate in low memory is ignored after a disk is initialized (at system start-up).

While this may seem to be dodging the question, those two locations are not in protected RAM; hence, no problems.

PROBLEMS WITH EARLY BASICS

atari.st/questions #877, from dbetz (David Betz, BIX), 708 chars, Thu Feb 5 10:23:20 1987.

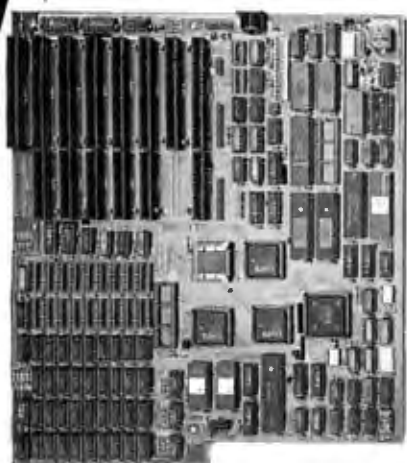
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SPRING COMDEX
BOOTH #4925

Eric Jensen, the guy who wrote the BYTE review of the 520ST, gave me a call the other day and reported a rather strange problem that someone reported to him. It seems that there are some *very* strange bugs in ST BASIC. His example was this:

```
x=18.89
```

He said (and I didn't verify this because I don't use BASIC myself) that this resulted in a strange error message having nothing to do with the assignment statement itself, something like "unimplemented function." He further said that multiples of the magic value on the right (18.89) would cause similar but different strange error messages. Can anyone else verify this problem and is there a solution?

atari.st/questions #878, from jimomura (Jim Omura), Thu Feb 5 10:38:46 1987. A comment to message 877.

I've confirmed that x=18.89 yields the error report. Where x=18.89, you can use x=x/100 and have 18.89 properly stored. Interesting though.

atari.st/questions #926, from neilharris (Neil Harris, Atari Corp.), Sat Feb 21 12:00:31 1987. A comment to message 877.

The numeric accuracy of the original ST BASIC leaves something to be desired. The new version, written to our spec by Metacomco, is one bug away from release, and performs much better this way.

atari.st/questions #931, from dbetz, Sat Feb 21 12:07:50 1987. A comment to message 926.

This wasn't really a problem with numeric accuracy. The messages indicated that BASIC got *very* confused while doing a simple assignment. Will the new version fix these problems also?

atari.st/questions #932, from neilharris, Sat Feb 21 12:14:31 1987. A comment to message 931.

* Well, I just tried x=18.89 in the new BASIC and it works fine.

atari.st/questions #933, from dbetz, Sat Feb 21 12:18:44 1987. A comment to message 932.

Thanks for checking it out, Neil. I'll pass the information on to Eric Jensen.

atari.st/questions #936, from sprung (Ron Sprunger), Sun Feb 22 00:21:21 1987. A comment to message 926.

Neil, have you tested the new BASIC from a shell? The old one didn't close its windows, so was unusable from a shell.

atari.st/questions #938, from neilharris, Sun Feb 22 01:25:37 1987. A comment to message 936.

I don't use a shell as a rule. But I do have the Mark Williams shell on the disk. Will check it out.

(. . . he quickly exits Flash, executes MSH, and runs BASIC. . .)

Everything worked fine, more or less. A bit sloppy-looking, there was an extra cursor when I ran BASIC, and some garbage left in the background, and when I quit BASIC I had a bunch of green on top of the screen, but it did work OK. Is that what you needed to know?

atari.st/questions #944, from sprung, Sun Feb 22 18:02:26 1987. A comment to message 938.

Actually, what matters is whether it works from the shell several times in succession, without the desktop being visited in the meantime. The desktop has some means of reclaiming windows, which I for one have been unable to duplicate. I can run BASIC or Logo or 1stWord from my shell once, but if I try to enter them a second time, that's all she wrote.

atari.st/questions #946, from neilharris, Sun Feb 22 19:46:48 1987. A comment to message 944.

I did go back and forth to BASIC from the shell several times. No problem.

HARD DISK TIPS

atari.st/questions #892, from jimomura, Fri Feb 13 22:06:39 1987.

What's the current wisdom in hard disk usage? If I use a computer often during the day and daily, is it better to park the head sometimes (say for breaks of 4 hours or longer) or is it better to keep it going? What's the point at which shutting down is better (or is it always better)?

atari.st/questions #895, from mlavelle (Mark Lavelle), Sat Feb 14 02:40:44 1987. A comment to message 894.

Parking certainly can't hurt (especially if you live in earthquake country), except to slow down your first access after the park. Shutting down is a tougher call. Mechanically speaking, it might be better sometimes, but the chips don't live as long if they get cycled a lot. Of course, the chips don't like line spikes either.

atari.st/questions #898, from jimomura, Sat Feb 14 10:04:33 1987. A comment to message 895.

I should also ask how bad it is to power down the drive without parking. That happened the other day due to a power failure.

Traditionally, the argument against stopping a hard disk at all is that head-crashing usually occurs on powering up. I've heard that a lot has been done about this, but I haven't followed the technology closely. I know that in some large commercial-quality disks, sufficient energy is stored to park the head on any unconventional power-down. I don't know if this is on all disks or just some. I presume that those disks automatically park. I guess I can presume that these disks don't (or you wouldn't need a "parkhead" utility). Leaving a disk running, of course, wears down the bearings in the drives and in time will wear down the capacitors in the power supply.

Also, is there any automatic head-cleaning system in these sealed drives to take off particle build-up that results from head crashes?

atari.st/questions #899, from heller (Robert Heller), Sat Feb 14 12:41:35 1987. A comment to message 898.

I know that *old* (open pack and cart) drives have a spring or magnetic arrangement, which retracks the heads on power- or spin-down. I think that the newer/larger hard disks have some similar hack.

Head crashes with Winchester drives: Usually the head/media section is a total loss. Could be rebuilt (i.e., at a factory), but usually those parts are junked. On *little* 5 1/4-inch jobs, it usually means replacing the whole drive. With bigger

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Winchesters (like DEC RA81s) you have to replace the main inner unit (sort of like a rebuild on-site).

Power cycling probably does at least as much harm as continuous running. The chips don't like the power coming and going and the drive motor has to work harder getting the disk up to speed vs. bearing wear, etc. Six of one, half a dozen of the other. I have not noticed severe problems with not parking the heads on little hard disks. It is only a problem if you plan to move the machine around. I always park the heads when I shut down my system. Of course, power failures cause it to be shut down without parking the heads.

atarist/questions #904, from jittsler, Sun Feb 15 17:38:15 1987. A comment to message 898.

The only time I park the heads of my hard disk drives is when I am planning on moving them somewhere (and I confess if it is just office-to-office, I don't even bother there). They seem to be pretty rugged.

As for cycling the power, I would guess that it could be a wash. I have one that gets cycled with the business day, and one at home that is on all the time for amateur radio purposes and haven't (yet) noticed any difference in this small sample size. I think most drive manufacturers do put some specification on spindle hours, so if you aren't using it, you might as well turn it off.

atarist/questions #907, from jim_kent (Jim Kent), Mon Feb 16 02:03:03 1987. A comment to message 904.

Besides, if it's in the bedroom, the fan will keep you up all night.

atarist/questions #905, from sprung, Sun Feb 15 23:09:14 1987. A comment to message 898.

I've got a dozen or so different hard drives, from 5 to 400 megabytes, most of which run 24 hours a day, 365 days a year. In the last five years, I've had zero disk failures. Because of having to move it around a lot, I parked my Supra 20 for the ST every day for about four months and packed it back and forth in a backpack. Likewise no problems. My brother swears it's better for the electronics to leave them running, so that's generally what I do. In my office at home, leaving three or four computers and drives and printers running all the time makes a lot of heat, so lately I've taken to shutting them down selectively. Hard to see that it makes much difference. I would sure never shut one down for a few hours - more like a few weeks.

IBM PC and Compatibles

We continue this month's Best of BIX with two threads from the IBM PC section. The first investigates the possible causes of a vexing intermittent error message in the system of Doug Webster, BIX's director of business and marketing. The final thread is a very long one that'll tell you everything you need to know about the index holes on floppy disks. This thread evolves into a discussion of where to get basic information on computer systems.

POSSIBLE CAUSES FOR PARITY ERRORS

ibm.pc/hardware #2288, from dweb (Doug Webster, BIX), Tue Feb 10 17:23:56 1987.

I've twice had something occur recently and can't figure out

LETTERS

including Review Feedback

PC Scheme

The review entitled "PC Scheme: A Lexical LISP" by William G. Wong (March) emphasized some of PC Scheme's advanced features, such as continuations and engines, but it did not mention environments (used to implement SCOOPS), streams (like lists, but with delayed evaluation), and ports (files and windows), which are also first-class objects. Also, Mr. Wong faulted PC Scheme for not including record structures, when, in fact, its define-structure is similar to defstruct in Common LISP and creates extensible structures whose instances are equipped with accessors and recognizers.

PC Scheme has a string-read function, called read-line, which reads a line from a port and returns it in a string. However, read-line does not echo when reading from input or from a window, a fact that impedes interactive programming.

Readers should note that PC Scheme also runs on the TI Professional, and it gives you control of the excellent graphics on this computer, as well as on the IBM PC. It also gives full control of character attributes on either computer.

Finally, Abelson and Sussman's remarkable book is not the only source on PC Scheme. Daniel P. Friedman's *The Little Lisper* uses PC Scheme syntax, and Kent Dybvig's new *The Scheme Programming Language* gives extended examples, including examples using continuations and engines.

Roger B. Kirchner
Northfield, MN

Atari 1040ST

I just read the review of the Atari 1040ST by Dave Menconi (February). Overall, it was a positive and generally unbiased review. However, there are a couple of points that I would like to bring up.

In the Disk Access in BASIC Read and Write tests, I found it disturbing to see ST BASIC results being graphed against the more optimized BASICs of the Amiga and the Macintosh. ST BASIC is the slowest, most clumsy BASIC available for the ST. It takes minutes instead of seconds to load relatively large files. For the reader to see this in a comparison with the other computers, it gives the illusion of the 1040ST being generally slow. This is not the case. Quite a few complete BA-

SICs for the ST are lightning fast, such as Fast BASIC from Computer Concepts or LDW BASIC. These alternate BASICs would speed up the 1040ST's test results significantly.

My second point concerns disk I/O speed and storage size. The ST drive capacity is 360K bytes and 720K bytes, as Mr. Menconi states. However, if you use one of the many formatting programs available in the public domain, you can pack just over 400K bytes on single-sided drives and around 809K bytes on double-sided drives while maintaining compatibility with all file-copy and file-load applications.

Rod Swanson
Napa, CA

I could not agree with you more that using ST BASIC in the benchmarks skewed the results. Unfortunately, at the time that I wrote the review (I completed it in September 1986 and started it some months before that), there were few alternative BASICs available. Thank you for pointing out some of the alternatives that have become widely available since then.

—Dave Menconi

I enjoyed Dave Menconi's review of the Atari 1040ST. Based on my experience with my functionally equivalent Atari, I have a few comments relative to the basically excellent review. First, I've found a good way to use the right mouse button with the desktop. When you have two or more windows open, you can hold down the right mouse button and use the left button to make a selection from another window. I have found this particularly useful when copying files from one disk (or RAM disk) to another disk, since you do not have to change the active window when using the right mouse button.

Next, Mr. Menconi states that if you have a folder open, "you cannot access any of the other files" on that drive. Actually, you can access those files: You simply open a second window for that drive by clicking on that drive. You can have up to four desktop windows open at any one time for accessing files.

Finally, Mr. Menconi says that "the icons are arranged for you." True, the icons do have a default position, but you are free to move them wherever you want on the screen. Then you can point to and

click on the option to save the desktop. Thus, the next time you boot from that disk, the icons will come up in the same position you established.

E. Frank Carlson
Maple Valley, WA

Thank you for comments, especially your tip about the left and right mouse buttons. I'd like to note that the icons I described as being arranged for you are not the icons on the desktop, but the file icons in a disk window, which are, indeed, arranged for you.

—Dave Menconi

This letter is a group effort in response to the review of the Atari 1040ST. We all have extensive experience with our Atari STs, and many of us have a great deal of experience on many other kinds of computers, including the Macintosh and the IBM PC. The review, in our opinion, was written with a preconceived bias and, as a whole, was negatively presented.

One comparison that Mr. Menconi made was between the 1040ST's TOS operating system and the Macintosh's Finder. He mentioned that the Finder was intended to be the "perfect user interface." If you are going to compare the 1040ST to a possible advantage of the Mac, then at least mention that the Mac is incapable of displaying color, a severe disadvantage if you consider user-friendliness. It should also be noted that the ST can run without the GEM desktop with any of several command-line interpreters using MS-DOS, Unix, or CP/M commands.

For some reason, Mr. Menconi presented the fact that the 1040ST does not include an RF modulator as a real negative. Of course, the IBM PC and the Macintosh don't have one, either. But if

continued

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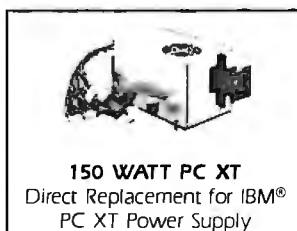
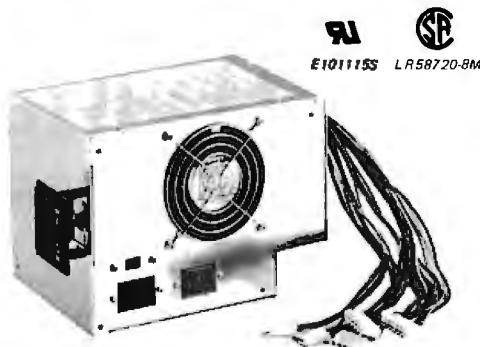
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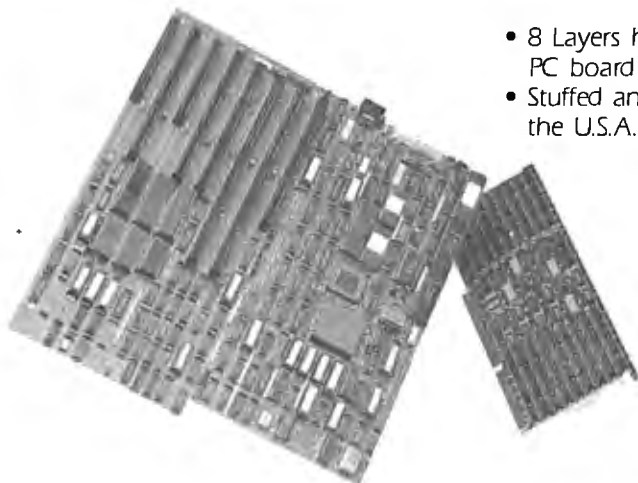
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LETTERS

you really need one, you can buy a third-party RF converter and add it to your ST. However, we are lost as to why someone would want to buy a \$1000 computer with the graphics quality of the ST and use a standard TV as the display screen.

Another point about user-friendliness: Isn't it nice to have all those function keys available? The Mac has no function keys. Switching resolutions is not a problem, either. It can be software-selected, as shown by the paint program, NEOchrome, which comes bundled with the computer. If you think that the ST method of switching resolutions is a quirk, then having to press Command-E every time you want to remove a disk on the Mac is a "QUIRK+."

Mr. Menconi made no comment on the ST's 640 by 400 monochrome screen or dual-resolution RGB monitor. He also did not mention that the system includes RS-232C, parallel, and DMA ports; a cartridge slot (for running Mac products faster than the Mac using the new Magic Sac emulator); or the MIDI ports. We had to laugh when we read the statement "Unfortunately, relatively little software is available that really makes use of the windows, menus, and icons so characteristic of TOS." While we agree that a good word processor has been a long time coming, most other areas have been taken care of quite well. Look at the public domain CP/M-Z80 emulator put out by Atari; the Macintosh emulator, Magic Sac; and the public domain emulators for the Apple II, Commodore 64, and Atari 8-bit software. There's also DEGAS Elite, a powerful paint program; GEM versions of VIP Professional and dBMAN; and powerful MIDI software.

The 40-folder limit per disk is not as Mr. Menconi presents it. You can have as many folders on a disk as you want, but, in the version of TOS he looked at, if you access more than 40 folders between system resets, you risk a directory error. However, some of us have ignored this precaution for as long as we've owned our STs, and no dire consequences have been reported. One last note: The Esc key does not update the screen; it only updates the current working window.

All in all, many people who are looking for a good, inexpensive computer with the advanced characteristics of the ST may be misled by this review.

Miami Valley Atari Computer
Enthusiasts (MVACE)
Huber Heights, OH

Thanks for your feedback on the review. I'd like to clarify some points you brought out, however. I thought it appropriate to briefly contrast the ST with the Macin-

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LETTERS

tosh, a major computer that has a similar user interface. It was not my intention to do a thorough comparison.

The graphics resolution, ports, and cartridge slot were all mentioned in the article or the text box. Since all this information was gone over in great detail in the Atari 1040ST Product Preview (March 1986 BYTE), I thought there was no need to repeat it in the review.

When I wrote the review, only about 20 percent of the software available made use of menus, icons, and windows. I am happy to report that this figure has been climbing steadily since then. The specific software products you mention either don't use menus and windows or simply weren't available at the time.

—Dave Menconi

53 Dot-Matrix Printers

I just had to write to express my appreciation for the review entitled "State of the Art in Dot-Matrix Impact Printers" by Jane Morrill Tazelaar and George A. Stewart (April). What a thorough analysis! This one review was worth the price of a year's subscription and is a great service to customers and vendors.

But I can't for the life of me figure out where you got the figures for sound levels in the graphics mode. Does the Department of Defense know about Radio Shack's DMP 130? A level of 583 dB is about 7 on the Richter scale.

Walter Clark
Fullerton, CA

Playing the Odds

Mr. Carlisle's letter in the March issue reminded me of another speed-up method I came up with while exploring the Mandelbrot set.

The idea is to exploit the area-coherence of the drawing—namely, the fact that it consists of large areas of constant color. If, for example, a pixel is painted red, then its immediate neighbors are likely to be red, too.

The algorithm regards the pixels of the drawing area as two interleaved groups (A and B), analogous to the black and white squares on a chessboard. Note that each pixel in group B is surrounded by four pixels from group A.

Phase 1 of the algorithm paints each pixel in group A using the regular iterations loop. Phase 2 paints each pixel in group B according to the colors of its four surrounding neighbors. If all four neighbors are of the same color, then the pixel receives that color. Otherwise, the pixel's color is determined the hard way—by the regular iteration loop.

Recurring trials with various parts of the Mandelbrot set indicate close to 50 percent reduction in run time. This im-

provement is due to the fact that very few pixels in group B lie close to the border between two colors. Consequently, the iterations loop has to be entered very few times during the second phase.

The price to be paid for increased speed is decreased accuracy. During phase 2, a pixel might receive the wrong color. Such errors, however, are hardly noticeable, because they can only occur in areas of the drawing where feature size is in the order of magnitude of two pixels or less; and even in these areas, the probability of a given pixel being painted incorrectly is only $(n-1)/n^4$, where n is the number of distinct colors used in the drawing. On my microcomputer, using 16 colors, this is less than 0.03 percent.

If the pixels in group B are processed in raster order, then each pixel in its turn has six painted neighbors. The colors of all six may be compared, to reduce the chances of error even further.

Ofar Faigon
Tel Aviv, Israel

The check for repeating values that Mr. Carlisle mentioned in the March issue will indeed speed up calculations for points that lie within the Mandelbrot set. However, it adds some overhead to each iteration, whether or not the point is in the set. This overhead is not worth it for most plots, because people tend to want to see areas that are dominated with points that do not lie in the set.

Mr. Chi's point on the magnitude of the cutoff (also in the March Letters section) requires some clarification. We agree that there is no magic cutoff, and 256 will work for initial explorations at low magnifications. However, at higher magnifications a larger number is often necessary. We have seen plots where a cutoff of 6000 or more significantly improves the picture.

Regarding speeding up the calculations: If you have the 8087 chip, we suggest that you program in assembler, use all eight registers, and go back to memory only when necessary. Also, 16 bits will not be enough for serious exploration—we suggest 32 bits or more. Mr. Chi's comment regarding fixed-point math is otherwise excellent.

Mark W. Bolme
Bellevue, WA

Perspective Check

In Kenneth Perry's article "Abstract Mathematical Art" (BYTE, December 1986), the following sentence caught my attention:

"These one-dimensional automata are 'mathematically irreducible'—there is no shortcut to determine whether a given

continued

Tim G. Hunkler

Atari 520ST Projects

An interface board for the Atari ST cartridge port

The purpose of this project is threefold: to present and test a technique for writing to the Atari 520ST's cartridge port; to build a simple but useful clock/calendar circuit; and to demonstrate some GEM dialogue-handling techniques using 68000 assembly language.

A little history is in order: One main feature of the Atari 520ST is the multitude of I/O capabilities available for the price. It has a serial port, a parallel port, a musical instrument digital interface (MIDI), a floppy disk interface, a direct-memory-access interface for hard disks, two joystick ports, and a cartridge port. With so many I/O methods, the Atari ST has a lot to offer the hardware hobbyist.

Initially, I had two projects in mind for my computer. The first would be an image digitizer that would mount on the printer's print head and let me digitize various images by using the printer to scan back and forth over the image. The second project was a floating-point coprocessor to enhance the ST's scientific and graphics applications. The most convenient connection for both projects would be the cartridge port.

The Problem

While I referred to the schematic for the cartridge port, a problem surfaced: The cartridge port lacks a read/write direction-control line. It appears that the cartridge port was designed as a read-only interface. Having a useful floating-point coprocessor requires that you be able to write data as well as read results.

Although it is possible to tap into a read/write signal within the ST and bring it out to the cartridge port, some additional testing indicated that this would be a futile effort. To protect cartridges from damage due to inadvertent writes, a cus-

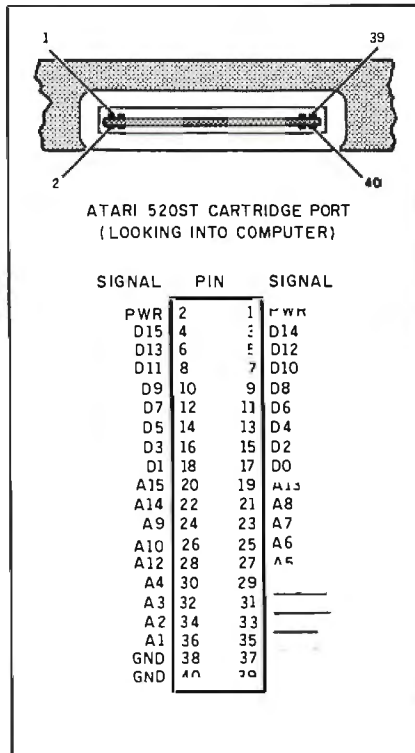


Figure 1: The Atari cartridge port and signals.

tom IC within the ST generates a bus error trap whenever a write to the cartridge address range is attempted for any reason. This protection feature means that you simply cannot create software that performs a write cycle to the cartridge port.

The Solution Revealed

The answer to overcoming the cartridge port's write-protection scheme is to give up using write cycles. A write cycle can be performed using a read cycle, some special software, and a little extra hard-

ware. I admit that this sounds bizarre but, because of the 68000's addressing power, you can actually use a portion of the address lines to pass data to the cartridge port and thereby overcome the write-protection scheme.

As an example, suppose you want to write the data value \$1234 to some hardware that you've attached to the cartridge port. How might you do this? A custom chip inside the ST decodes the range of addresses for the cartridge ROM address space. Two signals are produced and available at the cartridge-port connector. They are ROM3 and ROM4 (see figure 1 for cartridge-port pin assignments). When ROM3 is at logic zero, a read cycle is in progress from the address range of \$FA0000 through \$FAFFFF. Likewise, when ROM4 is at logic zero, a read cycle is in progress from the address range of \$FB0000 through \$FBFFFF (see figure 2 for signal timing).

The technique you use to write your data value of \$1234 to the cartridge port requires placing the data on the address lines, then reading from any address in the cartridge port address map. You need some external hardware to capture the data from the address lines and pass it to your desired destination. The software to do this might look like that in listing 1. The first line defines the symbol ROM3 to be the value \$FA0000. Line 2 ensures that the upper half of data register D0 will be zero when used in line 5. Line 3 loads a base address into address register A0.

continued

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Line 4 places the data you wish to output into data register A0. Finally, line 5 causes the data value \$1234 to be placed on the lower 16 address lines while an unknown byte value is read from the car-

tridge port and tested for zero.

One simple hardware design for writing data using address lines is shown in figure 3. The TST.B instruction uses an addressing mode called Address Register

Indirect with Index to form the address to be tested. This address is composed of three parts:

Address Register: A0.L = \$00FA0000
 Index Register: D0.L = \$00001234
 Displacement: \$00
 (sign extended to 32 bits)
 \$00FA1234

The address \$FA1234 is generated by the TST instruction and is output by the 68000, which is in turn decoded by the custom chip on the ST into a ROM3 select strobe. Meanwhile the data value \$1234 is presented on the lower 16 address lines during the read cycle caused by the TST instruction.

If instead of writing a single 16-bit value you wanted to output a block of 1024 data words, the program might look like that in listing 2.

With the 8-megahertz 68000 in the ST, this code executes in approximately 4.1 milliseconds, giving a data-transfer rate of a little less than 500,000 bytes per second.

Problems

Some problems occur when you use the 16 lower address lines as data lines. Unless the data being written is guaranteed to be an even value, a byte read cycle must be performed instead of a word or long-word read cycle. To do otherwise would result in a 16-bit word access to an odd address, which would cause an odd address trap and crash your program.

Also, the least significant address bit, A0, does not exist on the 68000 microprocessor. Instead, it is used to generate two other signals, the upper and lower data strobes (UDS and LDS respectively). On the cartridge-port connector, you can use UDS in place of address A0, as long as you use only byte read cycles.

When you combine the data in the index register with the address register, it is important that the upper 16 bits of the index register be zero and that the full 32 bits be specified for the index register. Otherwise, the data will be sign-extended, and the resulting address will cause ROM3 or ROM4 not to be selected.

You now realize that it is not as simple to write data to the cartridge port as you might have first guessed. It has the disadvantage of being slower than a direct-to-memory write cycle and requires that you perform some software contortions for every piece of data to be written. However, it does overcome the limitations of a read-only cartridge port and requires no hardware modification to the Atari ST. This method has a higher data-transfer

continued

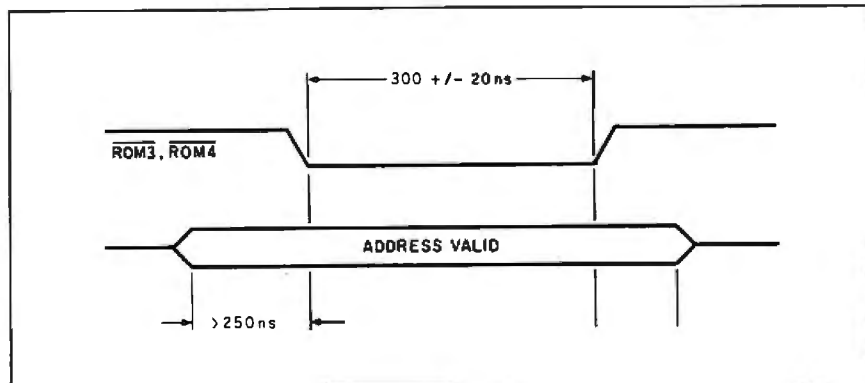


Figure 2: Cartridge-port address timing.

Listing 1: Code to transfer data to the Atari cartridge port.

```
ROM3 EQU $FA0000 ; define ROM select address
MOVEQ #0,D0 ; clear the register
LEA ROM3,A0 ; load ROM select address
MOVE.W #$1234,D0 ; load data into register
TST.B 0(A0,D0.L) ; dummy read
```

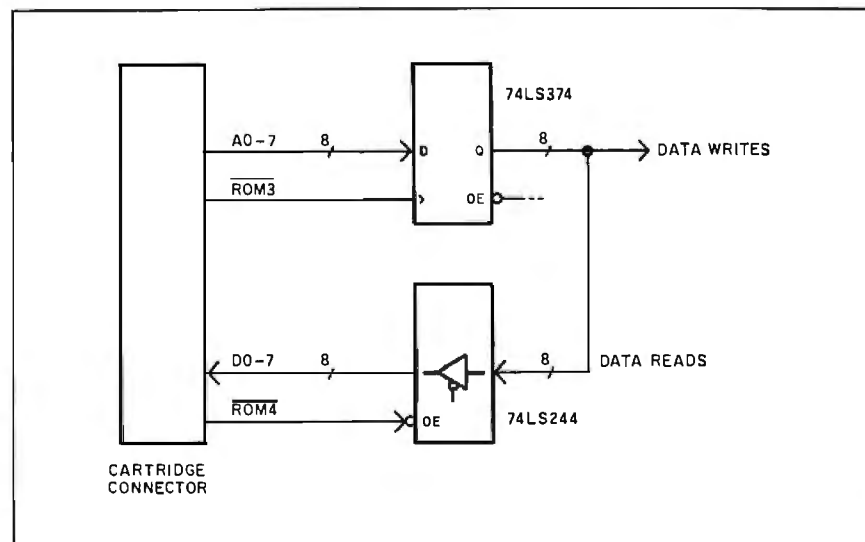


Figure 3: A simple circuit for data separation on the cartridge port.

Listing 2: Code to transfer a block of data to the cartridge port.

```
LEA DATA,A0 ; load address of data block
LEA ROM3,A1 ; load cartridge base address
MOVEQ #0,D0 ; ensure upper word is zero
MOVE.W #1023,D1 ; loop count = 1023 + 1
LOOP: MOVE.W (A0)+,D0 ; get next data word
TST.B 0(A1,D0.L) ; output word on address lines
DBRA D1,LOOP ; repeat for 1024 words
```

rate than the serial, joystick, or MIDI ports and is suitable for many hobbyist projects.

The Test Project

I chose a clock/calendar as a test project for the cartridge-port write technique. The clock/calendar circuitry is fairly simple and the finished project is a useful addition to the 520ST. However, another problem soon surfaced when I attempted to find a prototyping board that would

plug into the cartridge port. It seems that the cartridge port's 40-pin connector uses .079-inch centers between connector contacts. I tried prototyping boards with .050-, .100-, and .125-inch spacing, but none would mesh with the Atari connector. It appeared that the only solution would be to build a custom prototype board for the Atari. To my good fortune, Douglas Electronics of San Leandro, California built this custom prototyping board for the Atari and added it to their

catalog of board products. The resulting general-purpose wire-wrap board is quite flexible and will support roughly fifteen 16-pin DIPs or 128K bytes of EPROM.

Having solved the problem of the Atari connector as well as which prototyping card to use, I designed the clock/calendar circuitry; the result is shown in the schematic of figure 4. The components required for this circuit are given in the parts list in table 1. The circuitry is divided into three major functional areas:

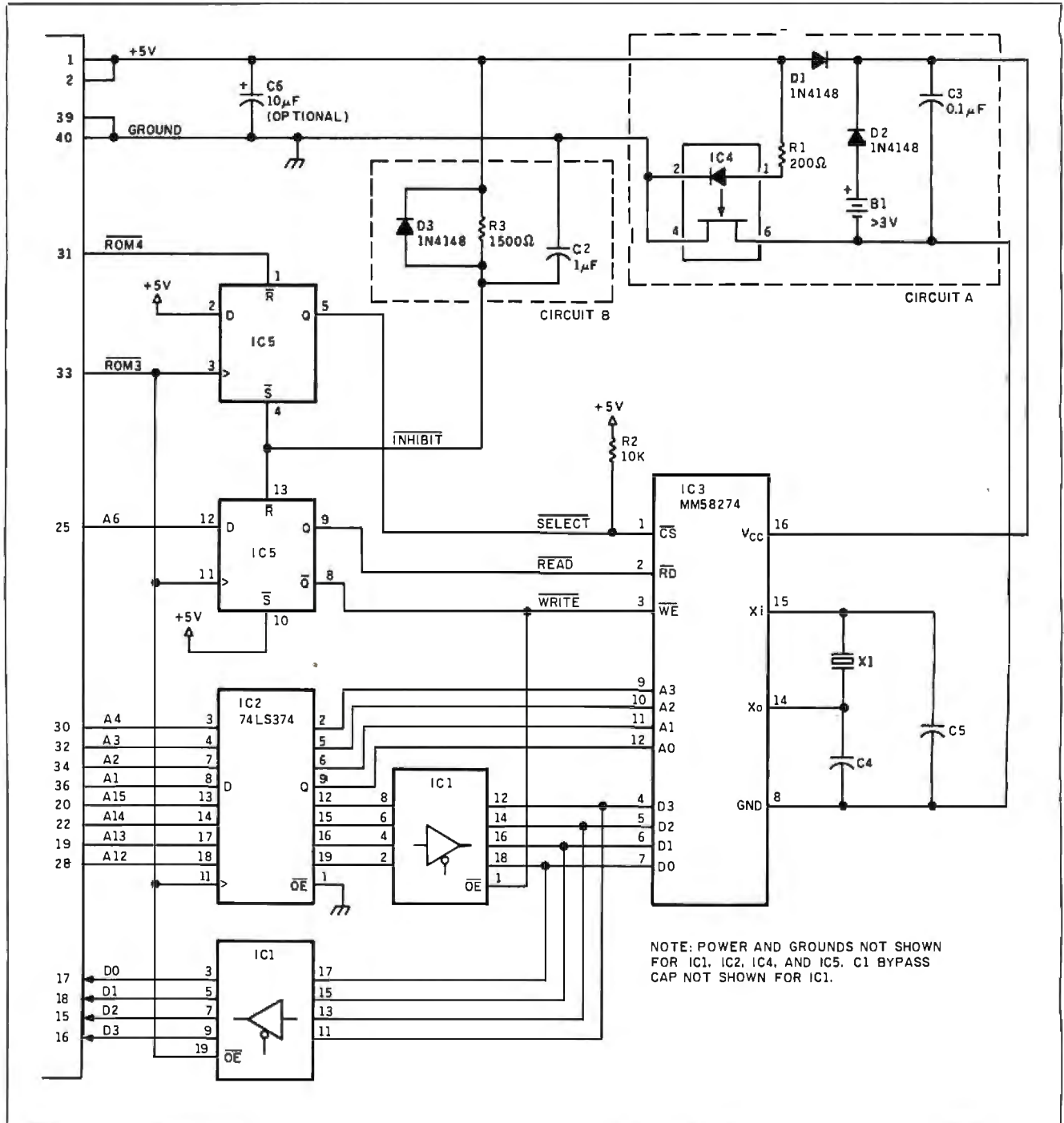


Figure 4: The clock/calendar circuit.

the interface to the cartridge port, the power-down isolation and keep-alive power, and the power-up/power-down glitch protection.

The Interface

Accessing the clock chip, IC3, is a three-step process. First, a 16-bit control pattern is formed and clocked into the IC2 8-bit latch and the IC5 flip-flop by using the ROM3 select strobe. This control pattern is coded as follows:

DDDD W.AAAA. where:

DDDD = data bits to write
W = read/write control
AAAA = clock register address
. = unused bit

The second step is a read cycle using the ROM4 select strobe. This causes the SELECT to be set low, and the clock chip is accessed for either a read or write operation setup by the W bit of step 1. If the operation is a read operation (W=0), the data from the clock chip is passed through IC1 onto the data lines of the cartridge port and is read by the software. If it is a write operation, the D bits stored in IC2 by step 1 are passed to the clock chip via IC1.

The third step involves a read cycle from ROM3 once again. This will cause the SELECT line to be set high and will end the read or write operation to the clock chip. It is possible to pipeline the accesses to the clock chip by combining step three of one access with step one of the following access.

Glitch Protection

The key to a successful battery-backup clock circuit is avoiding glitches during power-up or power-down that inadvertently produce write cycles. These write cycles can garble the time held by the clock chip. The glitch protection used for circuit B is not 100 percent reliable but is far simpler than alternative methods. The glitch-protection circuitry for power-up/power-down consists of R2, R3, C2, and D3. The R2 pull-up resistor increases the odds that the IC5 flip-flop will power up with SELECT high. The RC combination of R3 and C2 momentarily holds INHIBIT low during power up to force SELECT high and READ low. The D3 diode provides a fast discharge path for C2 so that quickly turning the power off and then on is properly handled.

Power-Down Isolation

The key to a long backup-battery life is eliminating current leakage paths during computer power-down. An effective way to do this is to disconnect the power and ground between the clock chip and battery from the rest of the circuitry.

Circuit A is used to provide power-down isolation and battery backup power while the ST is turned off. When the power is turned on, R1 and IC4 cause the ground of the clock and battery to be connected to the ground of the rest of the circuitry. With power turned off, the ground is disconnected and power is supplied through battery B1 and diode D2. Diode D1 eliminates leakage through the +5 volt line. Test measurements show a battery draw for this circuit under power-

Accesses to the clock chip can be pipelined by combining the read of the last access with the setup of the next access.

down conditions of 5 microamperes. When you use a standard 110- or 150-mA per hour coin-type lithium battery, the expected battery life would be on the order of 2½ years.

The Software

The software consists of two programs. The first, CLOCKSET.ASM, is a program that uses GEM dialogues to verify or change the time and date of the clock cartridge. It also automatically updates the time that both TOS and GEM report. The second program, TIMESET.ASM, will automatically set the time and date during the computer boot-up sequence. [Editor's note: Both programs are available on disk, in print, and on BIX. See the insert card prior to page 321 for details. Listings are also available on BYTEnet. See page 4.]

The first step in writing a GEM-based program is to understand the dialogues

continued

Table 1: Parts list for the Atari clock cartridge.

Item	Part No.	Description	Manufacturer	Sources
IC1	74LS244	Octal buffer	—	—
IC2	74LS374	Octal latch	—	—
IC3	MM58274	Clock calendar	National Semiconductor	—
IC4	H11F1	Opto isolator	General Electric	gikey (H11F1GE)
IC5	74LS74	Dual flip-flop	—	—
X1	—	32,768-Hz crystal	—	Digikey (X32768)
B1	I2325	Lithium battery	—	Digikey (P135 or P136)
BH1	—	Coin battery holder	—	Digikey (BH906ND)
D1-3	1N4148	Diode	—	—
R1	200 ohms	Resistor, 5 percent	—	—
R2	10k ohms	Resistor, 5 percent	—	—
R3	1500 ohms	Resistor, 5 percent	—	—
C1, 3	.1 µF	Bypass cap	—	—
C2	1.0 µF	Capacitor	—	—
C4, 5	18pF	Disk cap 5 percent	—	Digikey (P4403)
—	—	Header, 20 by 1	—	Digikey (929400-01-30), quantity 2
S1-5	—	20-pin WW sockets	—	Digikey (C8120), quantity 5
Board	33-DE40	Proto board	Douglas Electronics	(415) 483-8770

The Digikey references are followed by the part number in parentheses. Digikey's phone number is (800) 344-4539. Douglas Electronics' address is 718 Marina Blvd., San Leandro, CA 94577.

and windows. Dialogues are simple, fill-in-the-blank or select-a-button methods of displaying information and obtaining user input. Windows are a more general-purpose method and can be used for any number of display techniques, from screen editors to paint programs. CLOCKSET.ASM uses a dialogue because it is the simplest way to present the clock chip's time and date and to let you edit these items.

GEM provides function calls to draw a dialogue and to handle all user interaction with the dialogue in the form of the mouse buttons, and editable text fields. To use these routines, you have to define a resource tree that tells GEM how to draw your dialogue and how to react to your input. You specify a dialogue using a resource tree (a memory construct composed of a linked list of objects).

Objects are arranged in what is called a visual hierarchy. This arrangement requires that an offspring object must fit entirely within a parent object. Two or more objects within the same parent are called *siblings*. Siblings may overlap in any way

or not at all. Siblings can also have their own offspring, which may have offspring, and so on, resulting in a nesting of many levels. Resource trees are arranged so that the largest object or root object is first. The objects that follow the root object are ordered starting with the root object's first offspring, followed by the offspring's offspring, and so forth to the end of the list. The resource tree's second offspring of the root object follows, followed by its offspring.

Each object has three linkages: one to the next sibling, one to its first offspring, and one to its last offspring. Each object also contains an x and y coordinate that is an offset from the upper left corner of the parent of the object. Also present is information concerning a width and a height. The width and height together with the x and y offset calculate a clipping rectangle used when the object is drawn. Objects contain a general-purpose longword that, depending on the type of the object, can be a string address, the address of a text information block or icon, or can define a border thickness and color. Also present

are words with bit flags that define whether the object can be selected, has been selected, is marked, checked, crossed, disabled, and many other attributes.

The Developer's Kit available from Atari contains the Resource Construction Set (RCS) utility, which generates dialogues and other types of resources. For assembly language programming, it is convenient to use the RCS to build the dialogue and then save a C source-code version of the dialogue. This C source file is edited to convert it into a series of data statements used in the assembly language program.

Figure 5 illustrates the basic form that the dialogue box in CLOCKSET.ASM uses, as well as the corresponding linkage between the objects. Notice how the offspring objects are contained within the borders of their parent objects. Object 0 is the root object. Object 1 defines an inner framing box. Objects 2, 3, 4, 12, 13, and 14 are siblings and offspring of object 1. Objects 5 through 11 are siblings as well as offspring of object 4.

The main body of CLOCKSET.ASM is responsible for displaying the dialogue. Once the support routines are created, the procedure is fairly straightforward. CLOCKSET.ASM first initializes all GEM tables needed to make GEM function calls. The time is read from the clock cartridge and formatted for display in the dialogue. Next, a routine is called that displays the dialogue and waits for one of three buttons to be activated. CLOCKSET.ASM then processes the action required when that particular button is activated. This action will be either: exit the program (Exit), use the information on the dialogue to update the clock cartridge (Set), or update the dialogue information from the clock cartridge (Clock Cartridge). Except when you choose the Exit button, the dialogue is immediately reentered and the cycle repeats itself.

TIMESET.ASM is a short program that reads the time and date from the clock cartridge and modifies the time and date of both TOS and GEM. When it is placed in an AUTO folder, it will automatically execute during the computer boot-up process and correctly set the time, provided that the clock cartridge is present and working. TIMESET.ASM initializes the clock cartridge after power-up, reads the time and date, and updates the computer's version with this data. The time and date are also formatted and displayed on the screen. After a brief pause, the program exits. If the time or date is invalid because the battery is dead, the clock cartridge is not attached, or there is some other problem, an error message is displayed prior to exit. ■

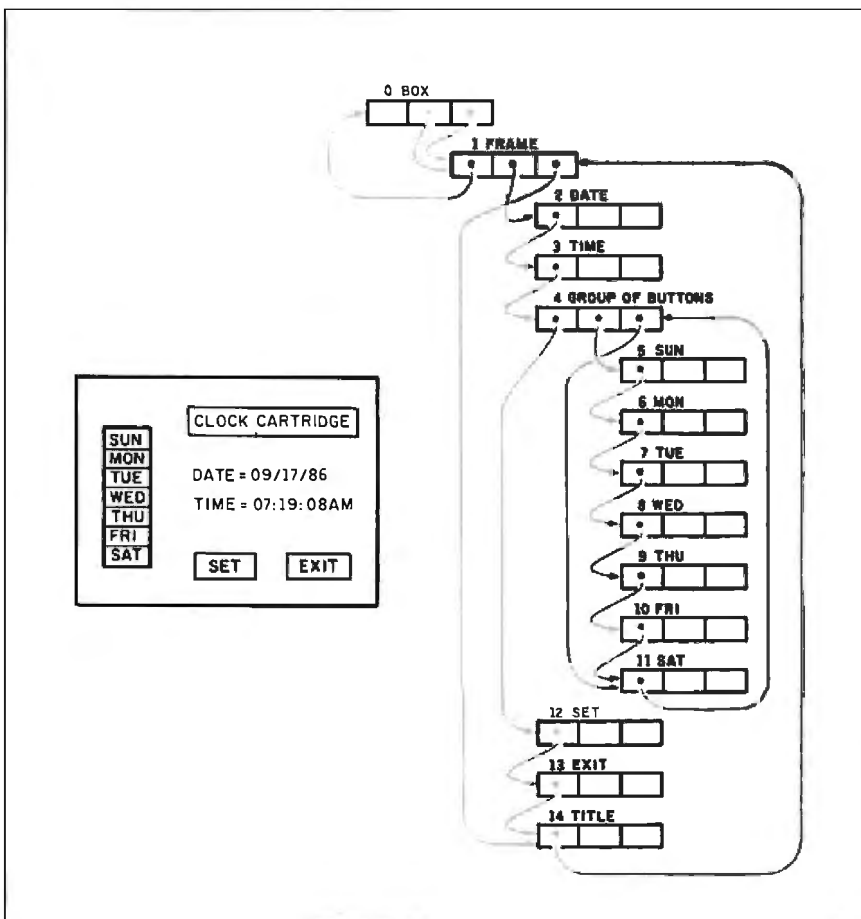


Figure 5: The dialogue box for CLOCKSET.ASM and the linkage between objects. The first object (0) is the root object, and object 1 is its offspring, or sibling. Object 1 is the parent of objects 2, 3, and 4. Object 4 is the parent of objects 5 through 11.

values as a built-in feature. I would also like to see concept functions include list-processing functions to manipulate these lists in various ways, based on user inputs.

An Effective Tool

Acquaint's frame-based knowledge-development system has a simple hierarchical class structure that allows multiple but limited property inheritance by subclasses. One unique characteristic is its forms feature, which allows experienced

users of expert-system applications to enter all their answers on a template at one time, rather than when the system asks for them.

Acquaint is one of the first IBM PC expert-system tools to use a frame-based approach to knowledge processing, allowing it to partition the knowledge base into structured rule sets that constitute distinct search spaces. Since you can keep the search within the bounds that are set by context frames, you can develop potentially huge, structured knowledge

systems without suffering from increasing inefficiencies.

Acquaint's three most attractive qualities are that it has surprisingly good speed performance for an interpreted LISP application (a subjective but not uneducated point of view); it can build large, efficient, partitioned knowledge bases; and you can configure each expert-system application with its own dedicated run-time package so the application's users don't have to pay a license fee to Lithp Systems for Acquaint. ■

Zoomracks II

Tyler Sperry

Zoomracks from Quickview Systems is a text-database manager distinguished by a unique visual interface. Unlike traditional database programs with numeric capabilities, Zoomracks is designed to organize character-based records of variable length, such as correspondence or research notes. Though basically a note organizer, the program can also handle related tasks, like simple word processing and calculations.

The program is currently available in two versions, Zoomracks I (\$79.95) and Zoomracks II (\$119.95). Zoomracks I lacks two capabilities of Zoomracks II: the ability to handle more than one printing format and the ability to save macros in disk files. Both versions of the program are available for the Atari ST series and the IBM PC and compatibles. I reviewed Zoomracks II on an Atari 520ST equipped with 512K bytes of RAM, two floppy disk drives, a color monitor, and a mouse. The package will run on a 520ST or 1040ST with a minimum of 512K bytes of RAM and a single floppy disk drive, and you can use it without a mouse.

The Zoomracks View

The feature that most clearly distinguishes Zoomracks from similar programs is its user interface. The program was designed by Paul Heckel, author of *The Elements of Friendly Software Design* (Warner Books, 1984), and Zoomracks reflects his concerns about a friendly interface.

Zoomracks' file-handling interface uses the metaphor of time cards in a vertical rack. Cards stored this way typically reveal the top line of information on each card, which permits quick visual searches. The time-card metaphor is

faithfully implemented in Zoomracks: Each database file is displayed as a rack of cards, with each card, or record, displaying the line of text contained in the first field of that record. This display lets you quickly scan a screen's worth of cards in a glance.

While not traditional, the Zoomracks display is easy to use in organizing material. Cards can contain up to 27 fields, and each field can hold up to 250 lines of text, with up to 80 characters per line. By displaying just the first line of information in a card, you can hide information in a manner similar to an outline processor.

Zoomracks lets you open and display up to nine files at once (assuming you have sufficient memory to hold them all). Normally, you wouldn't expect to view more than one or two files at a time, since a normal screen is only 80 characters wide. This is where a Zoomracks feature called SmartZooms comes in handy: By displaying text in a compressed mode (i.e., with some vowels and other characters deleted), it's possible to display several files at the same time.

Using the cursor keys or a mouse, you can quickly select and display individual cards or move between different files. Options are shown by a series of menus displayed at the bottom of the screen. To access the menus and submenus, you can use the mouse, Alt-key commands, or single-key commands. Once you've selected a menu, you use single-key commands to choose options. Virtually every menu uses the same key for entry and exit. Pressing the *Q* key once, for example, takes you to the menu for quitting the program; pressing *Q* again takes you out of the menu. An accidental keystroke merely toggles you in and out of a menu. The most common actions, like changing

the view of a card, are also available via function keys.

Despite the metaphor of time cards, the menus, and the mouse, Zoomracks' interface is not for everyone. It generates a rather quick polarity response: Some people take to it immediately, while others find it awkward to manipulate. Beginners will find the menu system reassuring and simple to use, but more experienced users who want to bypass the menus may find the command-structure shifts between function-key and Alt-key combinations cumbersome. Also, when you enter the program's editor, the traditional WordStar Control-key assignments are available when you edit a field; you cannot use these commands, however, when viewing a field. Finally, some of the commands—Alt-E for entering the "extra" submenu, for example—are non-intuitive. The upshot is that with all these different types of commands, it can be difficult to remember which ones pertain to the part of the program in which you're currently working.

A Standard Editor

Compared to the program's interface, Zoomracks' editor is more standard. Editing a card's field is easy: You simply select the card and field you want to edit and press a function key. In the editing mode, a number of commands follow the familiar WordStar Control-key conventions. The editor supports standard functions, such as searching and paragraph formatting, as well as extras, like the ability to insert the current date and time.

The editor is supplemented by print formatting with output forms. Each file has an associated output form that contains information such as headers, footers, and how each field will be printed, such as centered or flush-left. You change output forms, which consist of a series of formatting commands and field names, with the editor.

The combination of text editor and output forms is quite effective for applica-

continued

tions like mailing lists and printing three-up labels. It's also adequate for simple correspondence. However, Zoomracks cannot be seriously considered as a word processor. Missing features include printer-configuration options, underlining, boldfacing, italics, and other character-formatting options.

Design Quirks

You might expect the mouse to be heavily used in Zoomracks, a product designed to be the essence of user-friendly software, but this is not the case. In Zoomracks, mouse support is limited. You can use the mouse to select cards and racks to view and select menu items, but that's about it. You can also use the mouse to scroll through a rack of cards and "zoom" a card to fill the screen, but you have to go back to the cursor keys to scroll through the contents of the card you just pulled up. The mouse is not implemented in the program's editor; according to Quickview Systems, the editor will make use of the mouse in the next version of Zoomracks, planned for release later this year.

In addition, you must be careful to position the mouse precisely when using it to examine the Zoomracks file directory; placing the mouse inaccurately when activating the directory results in the creation of empty files. Also, if you're tempted to turn off the menu at the bottom of the screen, don't do it while using the mouse. The menu is simply rendered invisible, not disabled, and attempts at selecting a card at the bottom of the screen can result in unexpected menu choices.

Another problem concerns file handling. Zoomracks' user's manual claims the program can display pictures stored in the DEGAS format. Unfortunately, Zoomracks doesn't use the Atari's GEM interface or Alert boxes to select pictures for viewing. To view a DEGAS file, you type the file's name into a blank field and press a function key.

You won't run into trouble with this procedure if you've written down the name of the file you want to view, but if you haven't jotted down the filename, you may run into problems. Since you must enter the exact filename to view the file and the Zoomracks directory displays only those files that have the .ZRX extension, you're effectively forced out of the program to find out what's on your disk. In addition to making importing files a nuisance, Zoomracks' file-handling makes folder use awkward. You can open folders only from the Atari's Desktop, not from within the program.

When I tried to load a sample DEGAS file, Zoomracks refused, claiming that displaying a high-resolution picture requires a monochrome monitor, which I

didn't have installed. However, the file that Zoomracks rejected was a medium-resolution color picture that another program was able to display without difficulty.

Speed and Memory

For small applications that you normally associate with a card-file program, Zoomracks is certainly fast enough. I performed benchmark tests using a dummy database that consisted of 1000 records, numbered 1000 through 1999 in the first field. The other three fields contained dummy text strings of 32 characters each. The result of sorting the first field from reverse order was 36.3 seconds. Searching for the last record took 7.2 seconds.

You should note that Zoomracks is designed to handle ASCII text, and sorting is limited to ascending order. Sorts performed on numeric fields will thus lead to interesting results (e.g., 1, 10, 2, 3, ...) unless you manually pad the fields with leading zeroes.

The speed of Zoomracks in the benchmarks is largely due to the program's use of RAM-based operations instead of disk accesses. Thus, while it took only 7 seconds to search through the benchmark file, it took 55 seconds to load the file from the floppy disk—the program also sorts the file when loading it.

The speed gained through the program's RAM-based operations must be weighed against the RAM requirements for your application. Zoomracks cannot handle any file or collection of files larger than the amount of available RAM.

Moreover, this brings up other memory considerations. Experienced Forth programmers accustomed to having the functions of an editor, an assembler, and a compiler in 50K bytes or so will be surprised to find that Zoomracks, written in Forth and assembly language, weighs in at 227K bytes. When you add the RAM needed for the video display, the TOS operating system, and any desk accessories you've installed, the half-megabyte of memory on an Atari 520ST suddenly seems cramped. For example, I could not load the 114K-byte benchmark file until I had stripped my boot disk of several desk accessories.

Applications requiring less than 100K bytes of file storage should pose no problems. If your database is going to exceed 100,000 characters, however, it would be wise to consider dividing the database into different files or switching to an Atari 1040ST with a full megabyte of RAM.

Macros, Math, and Manuals

Zoomracks includes a macro capability that enables you to record a sequence of

Zoomracks II

Type

Text-database manager

Company

Quickview Systems
146 Main St., Suite 404
Los Altos, CA 94022
(415) 965-0327

Format

One 3 1/2-inch floppy disk; not copy-protected

Computer

Atari 520ST or 1040ST with 512K bytes of RAM and one floppy disk drive; mouse supported, but not required

Language

Forth; assembly language

Options

\$19.95 each for Business and other Starter Kits

Documentation

200-page user's manual; function-key template; command-reference card

Price

\$119.95; Zoomracks I costs \$79.95; an upgrade from the previous release of Zoomracks (the Premier version) to Zoomracks I is \$14.95; to Zoomracks II, \$49.95; versions are also available for the IBM PC and compatibles for \$119.95.

commands and link it to a single key. To replay the commands, you press a function key and then the assigned key. This capability goes a long way toward easing some of the awkwardness of the user interface. Instead of moving through a maze of menus to create and date-stamp a blank form, for example, you can assign the whole procedure to a single macro. You are limited, however, to 27 macros.

Zoomracks also includes some mathematical capabilities, which are limited to the basic arithmetic functions. These functions are certainly adequate to handle everyday applications like invoices and such, but not for complex number crunching. The program cannot, for example, automatically sum columns, although you can program a macro to perform this function.

The Zoomracks user's manual is tutorial in nature, generally well written, and indexed. The package also includes a

continued

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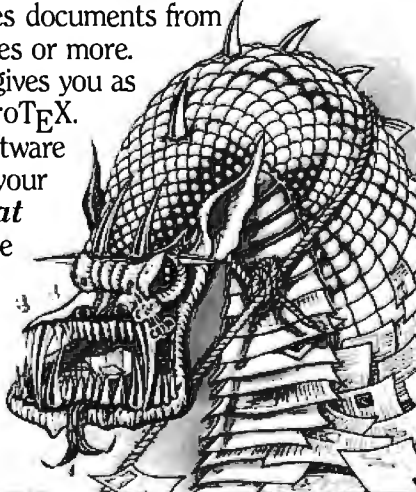
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Zoomracks is fast enough for small applications because of its RAM-based operations. But you'll have to weigh its speed against its memory requirements.

function-key template, a double-sided command-reference card, and an on-line help file, but no reference manual.

Quickview Systems provides good user support, especially considering that it's a small company. There is no toll-free number for assistance, and it might take a couple of hours to get a return call if no one is immediately available. The chances are excellent, however, that when you talk with people at the company, they will be knowledgeable and helpful.

As additional support, Quickview Systems sells Starter Kits for Zoomracks. These kits, which sell for \$19.95, contain a set of templates and macros for various applications. The Business Starter Kit, for example, contains templates for invoicing, phone logs, and so on. Sales, mailing list, accounting, and other kits are also available.

Best for Simple Filing

The final judgment on Zoomracks will depend on your planned application. If you're intrigued by the card-rack metaphor and have modest database requirements, Zoomracks is certainly worth investigating. There are some nonintuitive commands and bugs in the current version of the program, but, despite all that, it still gives you a useful tool for organizing and manipulating text data.

For demanding applications, however, none of the program's functions—text editing, database handling, and calculating—are sufficiently strong to compete head-to-head with a dedicated application program. Few word-processing programs, for example, are unable to handle simple underlining. As a working writer, I'd consider Zoomracks worthwhile for notes and simple correspondence only. For larger projects, such as this review, I'm quite happy to stick with my IBM PC compatible and a standard word processor. ■

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Every month, BIX users (also known as BIXen), leave thousands of messages on BIX. These messages ask and answer questions, solve problems, and express often strongly held opinions. The Best of BIX is a look at some of the most interesting messages. This month's contributions come from the Macintosh, Amiga, and Atari conferences. If you'd like to join the BIX community, see the advertisement on page 337.

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MACINTOSH

Not surprisingly, Apple's introduction of the Macintosh SE and the Macintosh II has generated some lively discussion on BIX. The following threads include comments from BYTE Technical Editor Tom Thompson (coauthor of the SE/II preview in the April BYTE). Author Larry Loeb is writing a review of the SE, which will appear in a future issue. Here, you'll see his initial reactions after receiving the SE for review. There's a lively discussion of why the SE doesn't use a 68020 processor, plus questions and answers about Mac II memory expansion.

MACINTOSH SE, FIRST REACTIONS

macintosh/mac.se #2, from tom__thompson (Tom Thompson, BYTE Magazine), Tue Mar 3 08:37:27 1987.

We were able to acquire a Mac SE so that we could handle questions concerning it. We've had a day to examine it before sending it out for a thorough evaluation by Larry Loeb. Here's what we can report so far:

1) If you're going to get one of these puppies, **MAKE SURE YOU ORDER A KEYBOARD**. Apple has unbundled the keyboard from the machine, so you can pick from two types of keyboards. A good idea, but somebody should make sure you at least get a keyboard, because our SE arrived without one. Since the SE gets its keyboard I/O through the Apple Desktop Bus, using a regular Mac keyboard is out. To be fair, it might have been a logistics snag. Apple did FedEx us one that arrived the next day. It doesn't seem as solid as the old Mac keyboards. I'm a keyboard "banger" (as opposed to a typist), and I'm afraid some day this thing might cave in on me.

2) Using "Get Information," I obtained the following version numbers for the system files:

System - 4.0
Finder - 5.4
Scrapbook - 2.1
Imagewriter driver - 2.5
LaserWriter driver - 3.3
Laser Prep - 3.3

3) The control panel devices are broken down into separate units that the control panel summons up, apparently to provide device independence in future machines. There was no 16-MHz option anywhere in the control panel settings.

4) You now have a Restart and Shutdown option in the special menu on the Finder. Restart is the old shutdown option (the

machine reboots) and Shutdown preps the machine for powering down (closes files, etc.). Activating Shutdown blacks the screen, and you get a dialog box stating that the machine can safely be turned off.

5) The cooling fan sounds louder than I remembered during the Apple visits, but my memory. . .

6) Beepinit works OK with the SE. I installed the Road Runner "beeps" as the SysBeep with no problem. It's got a 68000, so things should be compatible, but remember the size of the ROMs has doubled.

macintosh/mac.se #3, from lloeb (Larry Loeb), Tue Mar 3 09:56:50 1987. A comment to message 2.

The mouse is different, too. It slopes down to the cord and isn't as boxy as the standard Mac mouse.

Sucking an 800K disk onto the hard disk took under 2 minutes.

I'm NOT giving it back.

macintosh/mac.se #4, from jamurphy (Joe Murphy), Tue Mar 3 12:06:32 1987. A comment to message 3.

Some questions. . .

A) It has a straight 7.8-MHz 68000, correct?

B) Does it still have the external drive connector? If so, does that mean more than two floppy drives are supported?

C) Is there an external jack for video, or is that only supported through the expansion card? (You need a card for an external monitor.) If so, will we see color video boards for the Mac SE?

D) Finally, if the clock is on the motherboard and will last 7 years, does that mean there is no way to replace it? Are they saying that in 7 years nobody will be using the Mac SE? (In other words, that this machine has a 7-year life span?)

The Mac 512KE is gone, what about the Mac Plus? Its days are definitely numbered.

macintosh/mac.se #5, from lloeb, Tue Mar 3 12:14:44 1987. A comment to message 4.

1) Yes.

2) The external disk drive connector is there. Dunno about supporting more than two drives, though.

3) No external video output.

4) Dealer will have to unsolder and DISPOSE of the lithium battery, which is considered hazardous waste material.

5) I have a functional Plus (hacked Mac, 1 meg with fan). I don't see its days numbered at all. I think there will be a lot of 512K-to-1-meg upgrading going on as the software that won't run on the 512K becomes more prevalent.

continued

1-Mbit chips --- 4Mb/8Mb where: memory bank 1/memory bank 2
 4-Mbit chips --- 16Mb/32Mb
 16-Mbit chips --- 64Mb/128Mb

Obviously, we don't have 4- or 16-Mbit chips yet, but the potential is there. Conceivably, you could add memory via NuBus, but then you've got to go through a number of additional bus cycles to access memory—meaning your best bet is to put it on the motherboard.

As an additional note, memory speeds on the new Macs have improved. To wit:

Old Mac and Mac Plus -	200-nsec memory
Mac SE	- 150-nsec memory
Mac II	- 120-nsec memory

Even with the faster memory, the Mac II uses two wait states for memory access: one wait state for address translation through the hardware memory mapper (HMMU) or 68851 (PMMU) and one wait state for memory.

macintosh/mac.ii #19, from nz__mhamel, Fri Mar 6 18:05:56 1987. A comment to message 17.

Interesting. Sun's 3-Series workstations get away with one wait state, I think. Also *my* Mac Plus seems to have 120-nsec chips in it. Nice to know they aren't needed. . .

macintosh/mac.ii #20, from alf, Fri Mar 6 19:07:56 1987. A comment to message 17.

How can you fit a 1-Mbit chip in the same spot that was meant for a 256K chip? I know it's possible, but I can't figure out how it's done. Also, it's interesting that the Mac II uses such slow memory. The memory in this Mac goes for \$96.84 (at \$2.69 apiece, assuming one chip per 256K for parity checking) without any quantity discounts. This is a very small amount of money compared to the high cost of this computer. At least 100-nsec chips should have been used; who needs wait states?

macintosh/mac.ii #21, from tom__thompson, Fri Mar 6 19:47:48 1987. A comment to message 20.

As I understood it, the only way to eliminate the wait state was to use something with a 60-nsec access time. Shows how fast that 68020 is booking, doesn't it?

macintosh/mac.ii #24, from nz__mhamel, Sat Mar 7 18:09:27 1987. A comment to message 21.

It looks as though Apple is going for a conservative design, as usual. My 68020 book indicates you have around 120 nsec total from valid address to data wanted on a 16-MHz 68020. Add two wait states and that's 240 nsec. If the RAM takes 120, there's certainly plenty of time for memory management, buffer delays, etc. . .

The difference between five cycles to read memory (including the ROM, I presume?) and three cycles to fetch from the cache means there will be some incentive on this machine to keep those loops inside 64 longwords. Another job for the compiler writers, eh?

macintosh/mac.ii #34, from skraegloh (Stefan Kraegloh), Tue Mar 10 17:52:05 1987. A comment to message 24.

Actually it's 115 nsec from Axx valid to data wanted. Unfortunately, that's not a very useful specification. If you use dynamic RAM, you've got to start the access by asserting /RAS. Which, of course, you can do only if you know when a cycle will start. So what you were really looking for is the time /AS

valid to data wanted, which is 85 nsec worst case (at 16 MHz). But then /AS is *not* the only way to tell the "start of an external cycle" (hint, hint for those of you with a data book). In fact, I've built a 16-MHz 68020 card (for the VME bus) using 80-nsec dynamic RAMs and featuring *no* wait states*. By the way, these RAMs (IMS2800) were developed by Immos and are now manufactured by IMC. They are available down to 60-nsec access time! I've heard Compaq uses these RAMs in their 386 PC.

macintosh/mac.ii #35, from alf, Tue Mar 10 20:09:31 1987. A comment to message 34.

Actually, the Compaq 386 uses 100-nsec (static) RAMs, which is a little conservative. On the interesting side, guess what type of RAMs Compaq now uses in ALL their 80286-based machines? Also 100-nsec RAMs. Why Compaq uses the same speed RAMs in their 16-MHz 80386 machines as their 12-MHz 80286 machines beats me. But with their replacement of their 8-MHz 80286 machine line with 12-MHz machines (with no price increases) they have become the technological leader of the PC-compatible industry. So maybe they aren't so conservative after all.

ATARI

In the Atari section this month you'll find some thoughts on how widespread the use of hard disks is in the ST community. Then there's a discussion on upgrading 1040 RAM to 2 megabytes.

HARD DISK PREVALENCE

atari.st/main #1802, from davjon (David Jones), Thu Mar 5 21:16:26 1987.

Does anyone have any idea how many ST users out in the big wide world have hard disks? Is it worth making special provisions for them in software packages (aside from the usual copy-protection gripes)?

atari.st/main #1803, from sprung (Ron Sprunger), Thu Mar 5 22:28:20 1987. A comment to message 1802.

You might ask Supra how many they have out. I think they are becoming very popular - I have three. I was recently asked by a dentist friend to help him set up his ST, and he had a Supra 20-meg. I believe that any program that doesn't run conveniently on a hard disk will be in for a *lot* of criticism - these machines are powerful, and a substantial percentage of users will be on hard disks.

To be convenient on a hard disk, a program should be able to run from any directory while residing in any other directory. The user ought to have a way to tell the program where to look for its resources and where to put its results. In addition (and extremely important if used for serious purposes), if I execute it from e: \ron, and my wife executes it from f: \judy, we each ought to be able to exercise it on the files in our respective directories. I get royally griped with programs that dictate where resources and output go or that have a system specification for output. Output should go to the current directory, but provision should be made for system specification, if desired by the user.

atari.st/main #1805, from tsikes (Terry Sikes), Fri Mar 6 04:49:05 1987. A comment to message 1802.

I don't have a figure, but it seems to me that as hard disk prices go down and the ST is viewed more as a serious machine, many more people will have them. Supporting hard disks should be straightforward as far as software development goes, except

continued

for copy protection. However, you can always use the same copy-protection scheme as usual on your floppy, and use it as a key disk (like Habawriter).

1040 MEMORY UPGRADE

atari.st/main #1918, from jimomura (Jim Omura), Tue Mar 17 18:46:59 1987.

Has anybody upgraded a 1040ST to 2 megs? I'm starting to feel a need for a 2-meg machine.

atari.st/main #1921, from wes.peters (Wes Peters), Wed Mar 18 05:13:57 1987. A comment to message 1918.

Two megs is a little tricky to do. The machine (actually the MMU) is set up to address 1 or 2 banks of 256K-bit or 1-megabit chips. You could easily do 2 megs on a 520ST by switching to 1-megabit chips, but to do 2 megs on a 1040 (or any >1-megabyte configuration using 256K chips) would involve grabbing individual bits off the chip address lines when either RAS or CAS is strobed (while storing the lower bits in a FIFO), using the high-bit lines to select one of several banks of 256K chips, and then generating your own strobes while latching the stored addresses on the address line. Messy, very messy. On the other hand, if you replace your 256K chips in your 1040 with 1-megabit chips, which is fairly simple, you get 4 megs. . . Neat, huh?

atari.st/main #1922, from jim_kent (Jim Kent), Wed Mar 18 11:57:09 1987. A comment to message 1921.

Do you have to do any software fixes for the 1040 to recognize the 4 megs?

atari.st/main #1923, from jimomura, Wed Mar 18 12:13:49 1987. A comment to message 1921.

OK, anybody got a part number for the 1-meg chips? Also, any other jumpering or trace cutting, etc.?

atari.st/main #1924, from alexl. (Alex Leavens), Wed Mar 18 16:26:23 1987. A comment to message 1923.

1) No software changes are necessary; the machine will recognize the 4 megs automatically. 2) 1-meg chips have a different pin-out and 2 more pions than 256K chips do, so you'll have to do a *lot* of work to upgrade.

atari.st/main #1926, from wes.peters, Thu Mar 19 04:29:31 1987. A comment to message 1923.

Yeah, 411M believe it or not. . . . try Microprocessors Unlimited; I think they advertise in BYTE and I know they do in *The Computer Shopper*. As Alex mentioned, the 1-megabit chips have more pins and a different pattern than the 41256s, so you'll have to create a daughterboard to hold the new chips. Other than that, it should just be a matter of bringing the extra address line and the extra (unused) RAS and CAS signals from the MMU. I haven't looked at loading resistors for this yet, so don't run off and try it unless you have a real competent digital engineer or a disposable ST handy.

AMIGA

The highlights of this month's Amiga conference begin with an extensive discussion on the accuracy of timing on the Amiga. From there a BIXer receives help on a "crashing CloseWindow" problem. We finish up with some thoughts on task priorities under AmigaDOS.

TIMER GRANULARITY

amiga/softw.devlpmt #3904, from tjeffries (Tom Jeffries), Sat Mar 7 02:02:34 1987.

There was some discussion here several months ago about the granularity of timing on the Amiga. (Actually, if I remember right, the discussion was on hardware, but bear with me; I have a software question.) The company I work for is considering porting its main program to the Amiga but was concerned because it looked difficult to get timing more accurate than 16 milliseconds, and we need accuracy to about 1 millisecond.

I have two questions: Someone did come up with a solution based on using the timer, but it looked as though you couldn't use the blitter and that timer at the same time. Does ordinary text require the blitter? In other words, can a non-graphics-intensive application take over the timer that the blitter uses? (I think it was timer B, but I'd have to look it up.)

Second, I just ran across a reference in some code that seems to indicate that the "SendIO(&timerio)" routine accepts arguments in seconds and microseconds. Does that mean I could get timing accurate to some number of microseconds (obviously, less than 1000 microseconds), or is it just an overambitious structure element name?

amiga/softw.devlpmt #3905, from cheath (Charlie Heath), Sat Mar 7 02:19:25 1987. A comment to message 3904.

Normal text would use the blitter, and it can chomp considerable amounts of time even if you have another task running at a higher priority, once the text has started. I recently had to get a program running with a 50-microsecond window of accuracy, and I couldn't do it without disabling interrupts during the timed intervals. For 1-millisecond accuracy, you probably would not have to disable interrupts, but you might have to do some tricks. Does the text absolutely have to be displayed while the timing is active? How much processing occurs at the 1-millisecond intervals?

amiga/softw.devlpmt #3907, from tjeffries, Sat Mar 7 13:20:18 1987. A comment to message 3905.

I don't need lots of processing, I just need to keep track, in 1-millisecond increments with a reasonable degree of accuracy. Could I use the timer that the blitter uses? Hmm. . . if I understand what you are saying, it sounds like I would have to avoid large amounts of text being written. Do you have any idea how long it takes to write a single character to the screen?

amiga/softw.devlpmt #3910, from cheath, Sat Mar 7 17:20:10 1987. A comment to message 3907.

Text speed for single-character I/O is roughly 3 ms per character with standard text routines and roughly 1 ms per character with FastFonts installed.

If all you need is an accurate accounting of time, you can get that down to a resolution of a few microseconds using the vertical-blank counter registers. It takes a bit of calculation to get that into time format, maybe 20 microseconds of conversion in assembler. You'd also need a VBlank interrupt handler - they're pretty easy to install with RKM documentation.

amiga/softw.devlpmt #3911, from tjeffries, Sat Mar 7 17:30:32 1987. A comment to message 3910.

Thanks cheath, that's exactly what I need. BTW, why so slow printing text to the screen? The 68000 alone can do a lot of work in 1 millisecond; I would have expected the blitter to make things even faster.

continued

HyperPilot is the most powerful script language of all the programs I reviewed.

of 2400 bps for other protocols.

If a communications session fails because of problems, such as a disconnected phone line or high line noise, a built-in monitoring feature marks the point in the transmission at which the connection was broken. When you re-establish connection with the same remote computer, file transfer automatically restarts from the point of interruption.

Blast-II is menu-driven and easy to configure. The program includes a script language that can implement remote-host capability, and it has a WordStar-compatible text editor. The bottom line with this program is that for a given data rate, you can move a lot of error-free data faster than you can with other protocols.

Crosstalk XVI 3.61

You can tailor Crosstalk Communications' Crosstalk XVI version 3.61 for MS-DOS computers (\$195) to almost any application by using its powerful script language. This language enables you to create scripts that can recognize character strings, such as enter password, and it can suspend program execution until a predefined time.

Some novice users may have a problem with the program, as it is not menu-driven. The program has built-in automatic log-on routines for the more popular on-line services, and, with its English-like command language, you can build your own. You need to use only the first two letters of commands, for example, to load a BIX log-on script file, you type `lo bix`, and the program executes your automatic log-on. You can also execute this script from the DOS prompt by issuing the command `x talk bix`.

Crosstalk XVI incorporates Xmodem (checksum version only), ASCII, Kermit, and the unique proprietary Crosstalk file-transfer protocol. The program works with the newest modems that operate above 10,000 bps and even supports file transfers up to 115,200 bps for hard-wired lines.

For remote access, Crosstalk XVI has a 4-tier structure that lets you assign different levels of access for each individual caller. Access levels range from one remote user being allowed only viewing privileges to another remote user being allowed to take complete remote control

of Crosstalk. Even at the highest level, however, a remote user cannot access DOS.

[Editor's note: *The newest product from Crosstalk Communications, Crosstalk Mk.4, was not available in time for this review. The program features X.PC, Xmodem, and Kermit protocols and IBM 3101, DEC VT-100, and TeleVideo Model 900 terminal emulations. This package is based on a modular architecture (i.e., you can add enhancements by phone), and it has concurrent communications capability; you can run up to 15 simultaneous communications sessions, each displayed in its own window.*]

Flash 1.12

Flash version 1.12 (\$39.95) from Antic Publishing (formerly Antic Software) is a program for Atari ST computers. It accepts three types of commands. The quickest way to enter commands is using the Alt key and a single alphabetic key, for instance, to toggle the capture buffer on and off, you type Alt-C. The second way is by pressing the Insert key and typing a two-letter abbreviation at the command line. For example, to download a file using Xmodem, you press Insert and type `DL XM B: FOOBAR.PRG`. Flash checks the B: disk to see if FOOBAR.PRG already exists, and, if it does, it gives you a chance to overwrite it or abort the download process.

The third way to enter commands is to use a mouse and the GEM interface; this is the easiest but slowest way to operate the program. Using the GEM interface, you follow the pull-down menus and point-and-click on the functions you wish to perform. Here, speed is sacrificed for expediency.

Flash lets you operate in two different screen types: terminal mode and a 4K-byte capture-buffer mode. Terminal mode uses a blank screen with a status line across the bottom. Capture-buffer mode uses a GEM screen complete with scroll bars on the bottom and right sides and a menu bar at the top. At any time, you can switch between the two screen types by pressing the right mouse button.

The capture-buffer GEM screen gives you full cursor positioning with the mouse, and you operate commands through dialog boxes. However, when you use this screen, telecommunications is suspended; you can interact only with a remote computer while in the terminal mode.

You can manipulate the capture buffer contents using the built-in word processor. You can mark blocks of text, cut and paste, read files into the screen, and more. This feature also lets you edit messages and respond without going off-line.

Xmodem and ASCII are the only protocols available with Flash. The Xmodem protocol has fallback capability. If the CRC mode fails, the program automatically drops into the checksum mode. A dialog box lets you adjust the timing of an Xmodem protocol with the ambiguous settings of "loose" and "tight." This adjusts the Xmodem time-out response to compensate for slow systems; this is common during peak use periods. The loose setting is better for multiuser systems; for computer-to-computer transfers, the tight setting is preferred.

Flash's dialing directory holds 60 phone numbers. Phone numbers entered with an @ extension execute a .DO file. These .DO files are macros that are constructed using Flash's commands. The macros are somewhat crude, as there are no advanced features like nesting or conditionals.

The documentation for Flash consists of a 50-page paperback book that's adequate for the experienced user, but a novice could use more examples, especially in the section that explains macros.

HyperACCESS 3.20

HyperACCESS version 3.20 for MS-DOS computers (\$149) from Hilgraeve contains HyperPilot, the most robust script language of all the programs I reviewed. This script language, powerful enough to create a bulletin board system, contains 94 commands. Despite all its power, HyperPilot is easy to manipulate. Included are 30 prepared scripts to use as examples for writing your own commands. For most automatic log-ons, however, you won't need any more than three or four commands. The commands are very cryptic; two examples are `if wait match` and `if not wait match`. I would like to see HyperPilot make use of more English-like commands.

Once you've written scripts, HyperPilot automatically compiles them. This provides faster execution, and it keeps prying eyes from dissecting your scripts to reveal passwords and ID numbers, a common problem with placing script files on disk.

The phone directory holds 127 numbers and is extremely useful for travelers and those who use several of the popular packet-switched networks. All phone numbers are stored in a separate file. This allows you to use the same log-on script with several different phone numbers, a handy feature if you're dialing into the same on-line service from a different hotel room every other night.

The remote-access capability lets you leave your computer on-line when you're not using it. You can then choose to give the remote caller full or partial control of

SOFTWARE • PROGRAMMING LANGUAGES AND AIDS

True BASIC for the Atari

T rue BASIC, the structured programming language, is now available for the Atari ST.

Version 2.0 supports modules, which are used in languages like Modula-2 and Ada. With modules, you can share data between program segments or compile the modules separately and store as libraries for use with other programs. Version 2.0 for the Atari also supports graphics.

Price: \$99.95.

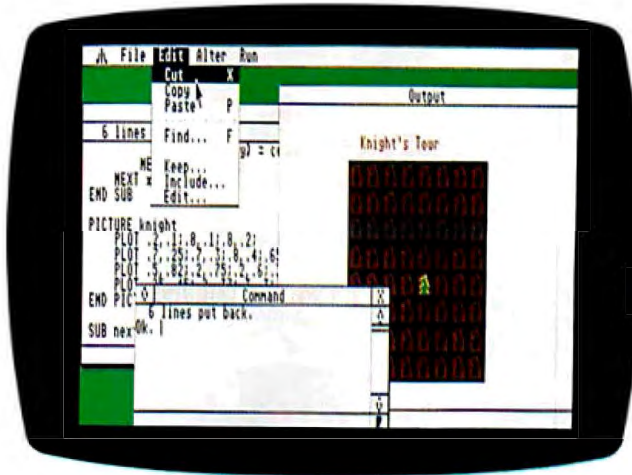
Contact: True BASIC Inc., 39 South Main St., Hanover, NH 03755, (603) 643-3882.

Inquiry 604.

Smaller and Faster Turbo Pascal Programs

Turbo Optimizer is a series of Turbo Pascal development tools designed to make your programs smaller and faster.

The Turbo Compactor takes your compiled Turbo Pascal .COM files and removes the unused portion of the object code. Most medium-size



True BASIC includes graphics and modules akin to Modula-2's.

programs are reduced by 7K bytes, according to Turbo Power.

The Object Optimizer speeds up your programs by up to 30 percent by removing unneeded instructions.

The Object Librarian lets you store compiled versions of your procedures in an object library, precompiled, so you can include them as externals.

Turbo Optimizer programs require an IBM PC, XT, AT, or compatible running Turbo Pascal 3.0 and PC-DOS or MS-DOS 2.0 or higher. **Price:** \$75; \$125 with

source code.

Contact: Turbo Power, 3109 Scotts Valley Dr., Suite 122, Scotts Valley, CA 95066, (408) 438-8608. **Inquiry 605.**

Go Forth

Go Forth is a version of 1979 Forth for the Apple IIe, IIc, IIGS, and III, which you can extend to the 1983 standard. It is ProDOS-compatible and uses ProDOS files. It writes programs as high-level languages and then compiles them to

machine language. It features an assortment of extensions, including a built-in system editor and an assembler.

Price: \$59.95.

Contact: Pair Software, 3201 Murchison Way, Carmichael, CA 95608, (916) 485-6525. **Inquiry 606.**

The Inner Workings of Pascal

Dr. Pascal combines an editor and interpreter in a Pascal program that lets you see the inner workings of a program during execution.

Visible Software reports that programs written and debugged with Dr. Pascal will run on most Pascal systems.

Dr. Pascal runs on IBM PCs and compatibles as well as other 8086-type systems with MS-DOS, PC-DOS, CP/M-86, or concurrent PC-DOS. The program requires at least 256K bytes of RAM and runs with most video adapters, according to Visible Software.

Price: \$59.

Contact: Visible Software, 22 The Western Way, Princeton, NJ 08540, (609) 683-4386.

Inquiry 607.

SOFTWARE • SCIENTIFIC AND ENGINEERING

Composite Design and Analysis

C LASS, or Composite Laminates Analysis Systems, is a desktop-engineering tool developed by Material Sciences and published by ASM International. The program lets you predict laminated composite material properties and perform point stress analyses.

The CLASS code uses the current lamination theory, ASM reports, and the code predicts the elastic constants, thermal expansions, strengths, and internal stress

states of a laminated composite plate.

CLASS stores constituents as transversely isotropic materials. You can store up to 50 each of fiber, matrix, and layer materials.

You can input layers, supply them based upon unidirectional layer data, or they can be computed layer properties. You can obtain the computed properties by combining a fiber and a matrix. When you compute the layer properties, the program es-

timates the strengths, supplying initial strengths for the layer. You can store the results of the layer analyses in the layers file, then construct a laminate by defining the layer's material, thickness, and orientation.

Laminate properties are displayed after you compute them, and you can then take the laminate into the failure-and-stress analysis section of the program.

You can calculate strength by using maximum stress, maximum strain, plane stress interaction, or qua-

dratic interaction criteria.

You can define the temperature, along with the load and strain state to be applied to the laminate.

CLASS runs on the IBM PC, AT, and compatibles with at least 256K bytes of RAM and MS-DOS or PC-DOS 2.0 or higher.

Price: \$295.

Contact: ASM International, Metals Park, OH 44073, (216) 338-5151.

Inquiry 608.

continued

Mechanical Engineering Design

M.E. Workbench is designed to let engineers explore the what-if possibilities of conceptual designs. Geometric modeling, variational geometry, equation-solving, and spreadsheet and word-processing capabilities are all features of this IBM PC-compatible software.

Changes you make to your designs automatically trigger recalculations throughout the system, so the window always reflects up-to-date data. You can also incorporate your results in word-processing documents generated by the system, and you can transfer your design via IGES format to standard CAD and MCAE systems.

M.E. Workbench runs on the IBM PC XT and AT with at least 640K bytes of RAM and 1 megabyte of hard disk space. The program supports the CGA, EGA, and Hercules-compatible adapters. You also need a mouse or other pointing device.

Price: \$2350.

Contact: Iconnex, 1501 Reedsdale St., Pittsburgh, PA 15233, (412) 321-8890. **Inquiry 609.**

Data Capture for the Geosciences

Data Capture Software (DCS) is a digitizing system for use in mapping, cartography, land-use planning, geology, and geophysics. You can use it to digitize map features, seismic and geological cross sections, seismic velocity functions, and graphs with linear or logarithmic scales.

The digitizing performed by the program is based on the U.S. Geological Survey's Digital Line Graph standard feature codes. The program supports 20 map projections, including UTM, State Plane,



M.E. Workbench lets you explore what-if conceptual designs.

Albers, Lambert, Stereographic, and Polyconic. It maintains 14 digits of numerical precision.

You can output cross sections and merge them with digitized locations to produce control-point records with depths, times, or other z-values. A merging utility program comes with DCS.

Velocity functions include one-way travel time versus depth, two-way travel time versus depth, one-way travel time versus velocity, two-way travel time versus velocity, and depth versus velocity. Output converts to two-way travel time versus velocity to facilitate depth conversion of seismic sections.

Another utility program comes with DCS that lets you convert longitude and latitude to X and Y, if you're digitizing maps without X/Y ticks.

DCS runs on the IBM PC AT and supports 21 digitizing tablet formats, according to Petrospec. The program requires 512K bytes of RAM, an RS-232C port, and two floppy disk drives, although Petrospec recommends a hard disk drive.

Price: \$600.

Contact: Petrospec Computer Geology and Geophysics, 4005 Burning Tree Lane., Garland, TX 75042, (214) 494-3364. **Inquiry 610.**

Typesetting Math on the Mac

Expressionist is an equation editor for the Macintosh that offers word-processing-type capabilities. You can use Expressionist to edit an equation on-screen using the point-and-click method, and you can paste an Expressionist equation into a document without leaving your word processor.

Price: \$54.95.

Contact: Allan Bonadio Associates, 1579 Dolores St., San Francisco, CA 94110-4928, (415) 282-5864.

Inquiry 611.

MathType is an equation editor that lets you create and edit mathematical equations and incorporate them into your word-processing documents. For the basic construct, the program provides a template consisting of symbols and empty slots. You can insert templates into the slots of other templates to create complex formulas, Design Science reports, and the program automatically sizes, spaces, and positions symbols according to the rules of mathematical typesetting.

As you edit and update

the equation, the display updates. You can output your documents with an Imagewriter or LaserWriter.

MathType requires a 512K Macintosh.

Price: \$149.

Contact: Design Science Inc., 6475-B East Pacific Coast Highway, Suite 392, Long Beach, CA 90803, (213) 433-0685.

Inquiry 612.

CAD on the Atari ST

GFA Draft is a menu-driven two-dimensional CAD program with functions selectable with the mouse. You can store up to 10 often-used drawings as symbols on the function keys, manipulate them with window functions, and print or plot them to scale and in color. Drawings can have up to 255 layers, 10 of which you can display at one time. You can use three types of lines, varying in thickness from 0.3mm to 4.5mm, and you can automatically position them, add construction lines, and add a variable-size grid.

You can incorporate text of different sizes, reflect, and rotate it. In addition to drawing functions such as rectangles, circles, and ellipses, you can drop a perpendicular from a line and place a line at a specific angle.

You can perform hatching automatically once you select the line angle and the width between the lines; double hatching is also possible. The program calculates scale automatically and can show distances in meters, inches, or millimeters. You can zoom in on portions of the drawing or reduce the picture for clarity.

Price: \$99.95.

Contact: MichTron, 576 South Telegraph, Pontiac, MI 48053, (313) 334-5700. **Inquiry 613.**

continued

The Best of BIX is a quick glimpse at a sample of the thousands of messages left each month by enthusiastic users of the BYTE Information Exchange. This month, sections are taken from the Amiga, Atari, IBM, and Apple conferences. A new section, the 32-bit Forum, is compiled from several conferences on 80386- and 68020-based hardware and software. For more information on joining BIX, see the advertisement on page 306.

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AMIGA

This month's Amiga section begins with a thread on getting rid of a pesky disk icon and ends with a short thread on the Amiga 2000 power supply.

THE ICON THAT WOULDN'T DIE

amiga/softw.devlpmt #3959, from danwest (Dan West), Mon Mar 30 21:27:42 1987.

I have a problem with disk icons. If a floppy is formatted internally in my program (Hardhat) and as a result has a new diskname, the new disk icon appears on the Workbench screen. However, the old disk icon does not disappear. The format function uses track format calls to the track disk.device, then writes a root block and a bit-map block, then sends an ACTION_INHIBIT packet to the process handler. The disk is validated and the new disk icon appears. Is there any way I can force WB to remove the old disk icon? If I double-click on the old disk icon, it accesses the disk as if it were still present under the old diskname. Everything concerning this reformatted disk works fine, it's just that this could be confusing for the user.

amiga/softw.devlpmt #3960, from neil (Neil Katin), Mon Mar 30 22:20:45 1987. A comment to message 3959.

The Workbench will remove a disk icon when there are no more locks present on that volume. If you can pull the disk out and the icon disappears, then there are no dangling locks. If the disk does not disappear after you format, then it means that you have not freed all the locks associated with the disk. Check your program for any locks that you have not freed.

amiga/softw.devlpmt #3969, from danwest, Thu Apr 2 21:43:23 1987. A comment to message 3960.

Thanks for your suggestion, Neil. Unfortunately, after going over the code with a fine-tooth comb, there doesn't appear to be any dangling locks.

Here is a sample scenario; maybe it will ring someone's bell:

From WB, bring up Hardhat and downsize its screen enough to see the disk-icon area on the WB screen. Place a disk with the label DiskA in df1: and the icon with this label appears in the WB screen. Select "format floppy" from the Hardhat menu and tell Hardhat to format df1: with the new name DiskB. After the format completed, a new disk icon appears with the label

DiskB, but the old disk icon with the label DiskA is still present. Remove the disk from df1: and watch the disk icon with the label DiskB disappear from the WB screen. Exit Hardhat and verify that the DiskA icon stays on the WB screen. Double-click on the DiskA icon and get a requester saying "No disk in df1:".

It would seem that you are correct and there is a dangling lock for DiskA, but no dangling lock for DiskB after the format. I just can't see anything in the code that would do this. CreatePort has a DeletePort, CreateStdIO has a DeleteStdIO, OpenDevice has a CloseDevice.

Any further ideas?

amiga/softw.devlpmt #3971, from dmilligan (David Milligan, Integrated Systems Inc.), Fri Apr 3 01:23:40 1987. A comment to message 3969.

In our program CLimate, we also have a format-disk function that writes a custom disk icon, and we've experienced the same problems for updating the icons to the new imagery. At DevCon in November we asked every Amiga tech-support person we could how to get Workbench to display the new icons, but no one had any answers other than "Eject and reinsert the disk." If you find the trick, we'd LOVE to hear about it. Good luck.

amiga/softw.devlpmt #3972, from danwest, Fri Apr 3 02:09:54 1987. A comment to message 3971.

My problem isn't displaying the new icon, but getting rid of the old icon. One suggestion: Are you forcing AmigaDOS to validate the new disk? I am doing this by sending an ACTION_INHIBIT packet with the Boolean flag set FALSE to the device handler. See "Inhibit" in the Technical Reference Manual, page 3-14.

amiga/softw.devlpmt #3983, from dmilligan, Sat Apr 4 03:11:16 1987. A comment to message 3972.

To be honest, it's been a few months since I messed with that, but I recall trying everything I could think of using ACTION_INHIBIT.

I believe one of the techies said that it's a Workbench function (the disk-icon bit) and can't be called externally.

I haven't tried doing a RectFill to the Workbench screen. If you can get away with that, you could kludge it.

Oh, well. They don't pay me to think, anyway. . .

amiga/softw.devlpmt #3975, from cmcmanis (Charles McManis), Fri Apr 3 03:04:00 1987. A comment to message 3969.

Yup, do a DEVICE_INHIBIT on df1:, then the DiskA icon will go away and the df1: icon will get a BUSY label. Then format the disk in drive 1 and remove the disk's inhibitions. :-) The BUSY will change to DiskB when it validates. It works; I just tried it. You should inhibit the drive before diddling the volume to lock out other tasks that might try to use it.

amiga/softw.devlpmt #3984, from dmilligan, Sat Apr 4 03:14:17 1987. A comment to message 3975.

GREAT!! Thank you! It's too late for CLimate, but I'll definitely sleep better now.

continued

This is based on the Zorro specs. Additional power is available for motherboard, hard disk, etc. The power supply at 200 watts should not be underpowered.

amiga/hardware #1215, from hazy (Dave Haynie, Commodore Technology), Tue Mar 31 17:06:29 1987. A comment to message 1201.

It's a 205-watt power supply, at least at present. You get 20 amps at 5V, something like 8 amps at 12V, 1/3 amp at -12V and -5V, and an extra 5V at 1/2 amp for things that go out of the box. In general, you can get at least 2.5 amps from each expansion slot. You really have to weigh what you're drawing against the other things around. An 8-megabyte board might draw 4 amps, but you're not likely to need much RAM beyond that, so you'll probably be OK with one large draw board. The parallel port has a 5V line through a current-limiting resistor, which is to prevent self-destruction when the wrong cable is plugged in. It's just like the A1000 parallel port: bidirectional 8 bits, a few handshake lines, synchronous serial port, etc.

ATARI

The Atari conference contribution this month starts out with a minidebate on the pros and cons of the Modula-2 programming language. It's followed by a very short thread on checking the remaining space on a disk. There's a look at blitter compatibility and using exec overlays. We finish off with a discussion of GEM desktop limits and uninstalling programs from the desktop.

MODULA-2 PROS AND CONS

atari.st/main #2054, from rswindells (Robert Swindells), Sun Apr 12 11:01:11 1987.

Aren't language religions fun? <grin>

My main complaint about Modula-2 is that by mixing uppercase and lowercase in function names, Wirth made it hard to type in source code. These functions are in the standard libraries, so you really have to use them. All the standard C libraries are lowercase.

The only Modula-2 compiler I have used was an ETH one, running on a VAX, which had no documentation and had been badly installed.

I always wondered why some letters were bigger than others, but that's the English education system for you.

atari.st/main #2055, from jimomura (Jim Omura), Sun Apr 12 11:35:53 1987. A comment to message 2054.

I can't keep track of which languages and implementations of same are or aren't case-sensitive. I presume them all to be either. Try to code in such a way as to make sure it doesn't matter. All my names are as unique as possible in the first 6 to 8 characters, but always typed in consistent with case-sensitivity. I've never known for sure if my Microware C is case-sensitive or not (or even any of my assemblers).

atari.st/main #2056, from mpack (Micropack Limited), Sun Apr 12 11:55:41 1987. A comment to message 2054.

Modula-2 identifiers aren't that difficult to understand (really). The convention is simple - you try to use whole words in identifiers, and you capitalize the first letter of each word, so the equivalent of a C function "do_something" is in Modula-2 "DoSomething." Knowing the convention, it really isn't that difficult to handle.

atari.st/main #2059, from jruley (John Ruley), Sun Apr 12 17:08:06 1987. A comment to message 2056.

Yeah - what gets nasty is when you see that convention in C, like the Amigoid. It's not really difficult, but it gets confusing at times, having both styles at the same time.

I do prefer the this_that convention - simply because it shows up better!

atari.st/main #2067, from jerry (Jerry Pournelle), Mon Apr 13 03:31:00 1987. A comment to message 2054.

It is very easy to write in Modula-2 with a Modula-2 preprocessor that will do anything you like with case-sensitivity and remake your code files to conform. You can also have it check syntaxes and stuff if you like.

atari.st/main #2075, from alexl (Alex Leavens, Dynamic Software Design), Mon Apr 13 22:38:14 1987. A comment to message 2067.

For those interested in Modula-2, the Workman and Associates' Modula-2 package is nearing final completion. From what I've heard about it, it's *real nice*.

CHECKING FOR DISK SPACE

atari.st/main #2076, from jgrossman (John Grossman), Mon Apr 13 23:47:57 1987.

Is it difficult to implement a check for lack of sufficient remaining disk space for a save operation on the ST (particularly a RAM disk)? If not, that would be a nice feature.

atari.st/main #2091, from sprung (Ron Sprunger), Wed Apr 15 23:05:47 1987. A comment to message 2076.

It is not difficult to check for sufficient disk space for a particular file-save, but the function needs to be implemented in the program doing the save. It is less straightforward with an editor, since it has no way of knowing in advance how big the file will be when you save it. If the program does not check, recovery is nonexistent as far as I can tell. GEM gives you the error message but does not seem able to recover.

BLITTER COMPATIBILITY

atari.st/tech #1904, from hisoft (Dave Howorth), Mon Apr 13 14:02:21 1987.

With the release of the blitter ROMs, we will find how compatible all our code is. One thing worries me: raster blocks for scrolling. To scroll a GEM window, we set up a raster block containing addresses and numbers (physbase, number of planes, etc.) obtained from BIOS calls. If an ST suddenly has a new screen mode, how will our programs work? Answer: bombs, probably. Could we have some guidelines for upward-compatible programming please?

atari.st/tech #1905, from jim_kent (Jim Kent), Mon Apr 13 18:08:14 1987. A comment to message 1904.

The megaSTs don't support any new screen modes. If you do scrolling with the 68000, it shouldn't be any problem; just a tad slower than the blitter is all.

If you're worried, maybe Neil or someone can tell us how to get your software as part of the test stuff they use on the blitter ROMs to make sure the ROMs are compatible. I know Jim

continued

Eisenstien (Eisenblit) has been working quite hard to make sure that some programs that did some rather silly things still run under the blitter ROMs. I've never had any trouble with my stuff, and it talks to the screen directly quite a lot.

atari.st/tech #1910, from neilharris (Neil Harris, Atari Corp.), Tue Apr 14 17:18:58 1987. A comment to message 1905.

Atari maintains a software library, watched over (like a hawk) by Juli Wade. If your program is in the library, it will be put through the "regression test" every time we do a change to the system. If a problem crops up, we will let you know.

atari.st/tech #1906, from alexl., Mon Apr 13 22:42:00 1987. A comment to message 1904.

From what I understand about the blitter and new ROMs, there *is no new screen resolution*. The blitter just makes everything move a lot faster. Also, unless the program is doing things in such a way that it depends upon the speed at which something is drawn, it shouldn't be able to tell that the blitter is there. The calls are supposed to be completely backward-compatible. And finally, there'll be a menu option that will let you turn the blitter off and use the old software routines instead. (All the old software routines are still in the ROMs, along with the new code to support the blitter).

EXECUTIVE OVERLAYS

atari.st/tech #1907, from psmith (Caesar Salazar, Manx Software Systems), Tue Apr 14 03:02:22 1987.

Does anyone have any ideas on how to implement a true exec() type function that overlays the calling program instead of spawning a child process the way Pexec() does? It appears that there might be some way of implementing exec() by magically usurping the Oxi02 Terminate Handler, but of course there isn't enough documentation to know how to proceed.

atari.st/tech #1908, from wes.peters (Wes Peters), Tue Apr 14 06:48:15 1987. A comment to message 1907.

One of the arguments to Pexec is a flag that tells the exec to "load," "exec," or "load and exec." You could write a loader that would load the new file in on top of the current one, fix up the basepage, and then call Pexec with a mode of 4 (just go) to start it up as an "official" GEMDOS program. You would have to put the loader in some protected part of memory, however, perhaps above the screen buffer. Sounds like a messy job. . . .

atari.st/tech #1909, from jim__kent, Tue Apr 14 17:17:34 1987. A comment to message 1908.

I was playing with the idea of a chain-type exec like this a few months ago. The fact that Malloc doesn't update the basepage's top-of-RAM variable complicates it further. If anyone succeeds in implementing an exec, I'd be curious to hear the details.

DESKTOP LIMITS

atari.st/questions #1040, from sprung, Fri Apr 10 01:37:22 1987.

I have gotten a query from a conference participant that I can't answer. It seems that when he installs programs via the desktop, he is limited in how many he can install. He was wondering if they can be installed, and indeed what installation accomplishes.

I had thought that installation of a program was merely a renaming of the extension to indicate that the program should be executed as a GEM, TOS, or TTP program. Why then would the desktop care how many programs I install?

Could we get a complete explanation from some desktop wizards?

atari.st/questions #1041, from jtittsler (Jim Tittsler, Atari Corp.), Fri Apr 10 02:24:07 1987. A comment to message 1040.

While you can change the extension to indicate the type (GEM, TOS, TTP), you can also use Install Application to specify a type, as well as specify a document type (extension) that will be associated with that application. This information is stored in DESKTOP.INF. I suspect the limit you refer to is a function of the (finite, and unknown to me at the moment) maximum size of that file.

PROGRAM UNINSTALLATION

atari.st/questions #1051, from sinclair (Bill Sinclair), Sat Apr 11 09:30:48 1987.

Suppose I have installed too many programs in my DESKTOP.INF, and the system won't let me install any more (as has happened many times). Is there a simple way to UNinstall programs I don't want to use for the time being? I was thinking of applying the editor to the DESKTOP.INF file, but that could be dangerous.

atari.st/questions #1052, from mlavelle (Mark Lavelle, Logitech Inc.), Sat Apr 11 12:13:43 1987. A comment to message 1051.

Actually, it's easy to use an editor to do that - just don't do it in a document mode. All you have to do is kill whatever line has the extension of the data files for the program you want to uninstall. The problem is, you'll have to reboot to make it effective. Are you installing programs without setting a default data extension? That's probably a waste of space.

atari.st/questions #1053, from jim__kent, Sat Apr 11 15:05:40 1987. A comment to message 1052.

When possible, just change the program's name to .TTP and forget about installation.

atari.st/questions #1060, from sinclair, Sun Apr 12 14:54:29 1987. A comment to message 1052.

What happens if two installed programs have the same default extension? Does it get the first one you installed?

atari.st/questions #1061, from mlavelle, Mon Apr 13 00:30:57 1987. A comment to message 1060.

I don't think I've ever even tried, but I'd hope the desktop wouldn't let you do that, or at least not store two entries with the same extension in DESKTOP.INF.

IBM PC AND COMPATIBLES

This month's IBM window consists of a short thread on device drivers and then a long one on multitasking that shows how a new topic begins and evolves on BIX.

CHANGING DEVICE DRIVERS

ms.dos/commands #536, from giro (GIRO Inc.), Tue Mar 31 17:35:52 1987.

Is it possible to remove a device driver that was installed by the DEVICE= statement in the CONFIG.SYS file without rebooting

continued

Professional Drawings with Windows

Instinct Plus, a technical drawing program, runs in the Microsoft Windows environment. Cadlogic reports that Instinct Plus is the advanced version of Instinct and operates with the same interface.

Enhancements in Instinct include multiple drawing windows and views that you can work in simultaneously, enhanced text-handling and bit-map capabilities, 512 colors to choose from, additional pattern textures, added graphics commands, and eight levels of Undo. Symbol handling is also enhanced in Instinct Plus, offering you the capability of naming individual symbols.

The program requires Microsoft Windows and runs on IBM PCs, XTs, ATs, or compatibles with at least 320K bytes of RAM. Cadlogic recommends 512K with a hard disk drive. You also need an EGA, Hercules Graphics Card, or other Windows-compatible device, and a mouse or other Windows-compatible input device. Word processors supported include Windows Write, Microsoft Word, ASCII Text Files, and others. It also supports Windows Paint and Aldus PageMaker. **Price:** Under \$300. **Contact:** Cadlogic Systems Corp., 2635 North First St., Suite 202, San Jose, CA 95134, (408) 943-9696. **Inquiry 580.**

Run IBM Software on the Atari

PC-Ditto, an emulation program from Avant-Garde Systems, enables an Atari 520ST or 1040ST to run IBM software, including Lotus 1-2-3 and Flight Simulator.

The program features up to 703K bytes of usable memory (on the 1040ST), monochrome and color graphics capabilities, serial- and par-



Instinct Plus, an enhanced version of Instinct.

allel-port emulation, and support of 3 1/2-inch 80-track drives and optional 5 1/4-inch 40-track drives.

Price: \$89.95.

Contact: Avant-Garde Systems, 381 Pablo Point Dr., Jacksonville, FL 32225, (904) 221-2904.

Inquiry 581.

PC-Based Background Voice Mail

Although the CAM (complete answering machine) is not the first voice-mail card for PCs, it is the first to operate in the background so that the computer answers the phone even while you're using your system for other things. The three-quarter-length CAM board, available from The Complete PC, uses proprietary circuitry to digitize human speech and proprietary compression algorithms to store them on a hard disk. A 5-minute message takes about 1 megabyte of storage space on the disk, or about 3 to 3 1/2K bytes of disk storage for each second of speech.

The CAM system enables several people to have private, password-protected voice mailboxes and personal greetings for each mailbox. Additionally, frequent callers can be assigned their own mailboxes, and confidential messages left for them. As mes-

sages are read, it is possible to forward them to other mailboxes, and users can listen to their messages, record outgoing messages, record new personal greetings, or change CAM parameters from a remote Touch-Tone phone.

The system requires DOS 2.1 or higher, a hard disk, 384K bytes of RAM, a standard Touch-Tone telephone, and a Touch-Tone telephone line. An external speaker, which plugs into the card, is also recommended.

Price: \$349.

Contact: The Complete PC, 521 Cottonwood Dr., Milpitas, CA 95035, (408) 434-0145.

Inquiry 582.

Sharp's Newest Portable ATs

Sharp Electronics Corporation has a new family of AT-class portable machines. The 80286-based portables, which are part of the new PC-7200 family of "compact personal computers," are available in two configurations. The PC-7202 has dual 5 1/4-inch floppy disk drives, and the PC-7221 has a single 5 1/4-inch floppy disk drive and a 20-megabyte hard disk drive. Both units use

supertwist liquid-crystal backlit displays with 640- by 200-pixel resolution and four levels of gray scale. In addition, the units have PC AT-style keyboards and Phoenix BIOS. Both weigh approximately 21 pounds and come with 640K bytes of RAM, expandable to 1.6 megabytes on the system board.

A full-size expansion slot is built into the side of the machine. To insert a card, you remove a small panel from the side of the PC and slide the end of the card into the slot, much the way you insert a disk. Both systems run at 6, 8, and 10 MHz and include serial, parallel, and CGA/MDA video ports.

Price: 7202, \$2995; 7221, \$3995.

Contact: Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430, (201) 529-9500. **Inquiry 583.**

LX-800 Fast and Inexpensive

Epson's LX-800 printer, a 9-pin, 80-column dot-matrix model, is the company's lowest-priced printer. Epson claims the unit prints at 180 characters per second in elite draft mode and 30 cps in near-letter-quality mode.

Standard features include a built-in pull-type tractor feed, a 3K-byte buffer, automatic single-sheet loading, a parallel interface, and a one-year warranty. Also included is a SelecType front panel that lets you select fonts, type styles, and pitches without having to change DIP switches. The LX-800 comes with both roman and sans serif near-letter-quality fonts installed.

The LX-800 measures 3.6 by 15.7 by 12.1 inches and weighs 11.02 pounds. Available options are 32K-byte serial and parallel buffered interfaces.

Price: \$269.

Contact: Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505, (213) 539-9140.

Inquiry 584.

continued

keep a port from being created. Create your port and set UserPort to its address, then modify IDCMP. By the time you ModifyIDCMP(), you should have done the software interrupt voodoo for your port. Set window->UserPort to NULL before closing your window (or setting flags to NULL), or Intuition will try to delete your port incorrectly.

Forgive me if you know all of this. By the way, are you crashing or not seeing any effect? You can practice by sending a message to yourself in a test program (don't need two tasks) and seeing if you get the basic thing working. If you use Aztec, be sure to call geta4() and that new function he has (??) or manually set up your context (a4) and preserve registers.

amiga/softw.devlpmt #4083, from jbergstrom, Wed Apr 15 00:43:34 1987. A comment to message 4060.

Thanks for the info. I'll try your approach soon and let you know what color smoke I get. While attempting to test the basic skeleton of the thing, I ran into new problems in the use of the Exec CAUSE routine. The problem in both cases is that the interrupt code never gets executed. No crash, but no interrupt, either. I tried setting the softint bit in the intena register, but I reckon it is already set. Installing my (really innocuous) routine as the handler of all softints has predictably disgusting results. . . the big chill.

amiga/softw.devlpmt #4084, from cheath, Wed Apr 15 08:57:34 1987. A comment to message 4083.

Pretty sure you don't want to muck with the intena register for softints. Have you tried the audio.device softint example?

amiga/softw.devlpmt #4114, from jbergstrom, Sun Apr 19 03:07:52 1987. A comment to message 4084.

Intuition with softints works very well now. At long last I found the error of my ways: Setting the node type in the interrupt server structure to NT_SOFTINT. With that field set to 0, all works as advertised. Thanks to all for help.

amiga/softw.devlpmt #4116, from cheath, Sun Apr 19 03:12:23 1987. A comment to message 4114.

Great! I can't wait for an excuse to try out IntuiSoftInts myself now!

ATARI ST

The ST section this month covers the innovative three-inch solution to the common problem of a loose "glue" chip. An idea to increase the speed of the ST disks by increasing the cluster size is thrown around with some hope that this will also overcome the 16-megabyte volume limit in TOS. Participants reveal shortcuts on the desktop and discuss ways to execute a program more than once without reloading it.

THE THREE-INCH SOLUTION

atari.st/questions #1067, from sgreenwald (Steve Greenwald), Fri Apr 17 00:27:25 1987.

Maybe someone can help with this problem. We have an Atari 520ST with an SF354 disk drive. It has worked fine, but now when we read a disk with data on it, it indicates zero bytes contained in zero files. This happens with any disk we put in. I know it sounds as if the disk drive is fried, but if anyone can help, we would appreciate it.

atari.st/questions #1074, from ldyer (Landon Dyer, Atari Corp.), Wed Apr 22 22:48:32 1987. A comment to message 1067.

I have usually found this problem to be related to a gummed-up or misseated glue chip:

1. Pick up your ST and drop it about three inches to the table. This is a tried-and-true technique in our Taiwan manufacturing plant.

2. Get your dealer to reseat the chips for you.

FASTER I/O THROUGH LARGER CLUSTERS

atari.st/main #2103, from davjon (David Jones), Sun Apr 19 18:50:22 1987.

One of the most annoying aspects of TOS file handling is the ridiculous amount of time it spends searching the FAT chain when it is creating files. It struck me that one way to reduce this delay would be to use larger cluster sizes - the bigger the cluster, the less there are, and so the less time TOS takes searching through them. I thought I'd give it a try, so I backed

continued

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Inquiry 37

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Inquiry 2

Inquiry 103

up my hard disk, wrote a few lines of C to change the sectors-per-cluster value in the partition C boot sector and did some tests. I changed the boot record for 8 sectors per cluster (the same as most IBM PC hard disks use) and then tried creating files on the drive. I created 342 files on the disk of varying sizes in 11 minutes. The same operation with normal clusters took 17 minutes. I wonder why Atari plumped for two-sector clusters on hard disk systems? Granted, the bigger clusters are more wasteful, but the hard disk really gains a lot of performance by doing so. The times above included the time to read the files from floppy. But it seems that the actual file-creation process is 2 to 3 times faster when using super-clusters. Comments anyone?

atari.st/main #2104, from mmallett (Mark Mallette), Sun Apr 19 19:07:32 1987. A comment to message 2103.

That's definitely valid. In fact, one of the things that Berkeley did to Unix to make their "fast file system" was to allocate space in several classes of block size. Perhaps a variable-cluster-size scheme would make sense in MS-DOS-style allocation as well - though I think any investment of time in this disk format on the part of Atari would be a waste.

atari.st/main #2105, from mpack (Don Milne, Micropack Ltd.), Sun Apr 19 19:54:17 1987. A comment to message 2103.

I wonder if you can create partitions larger than 16 megabytes with that trick? The FAT size should be the limiting factor.

atari.st/main #2123, from ldyer, Wed Apr 22 22:28:29 1987. A comment to message 2105.

The FAT size is not a limiting factor. Partitions are limited to 16 megabytes because of a sign-extension bug in GEMDOS. Period. Even twiddling the FAT sizes won't help.

MULTIPLE SELECT DESKTOP TRICKS

atari.st/software #397, from mlavelle (Mark Lavelle, Logitech), Sat Mar 7 13:23:48 1987.

In the Desktop, if you hold down the Shift-left key while selecting a file, any other previously selected files stay selected. You can also unselect a file from a group of selected ones the same way.

atari.st/software #399, from sprung (Ron Sprunger), Sun Mar 8 02:59:19 1987. A comment to message 397.

So that's how it's done! I saw a fellow do that, but couldn't see what his fingers were up to. Nifty.

atari.st/software #400, from jimomura (Jim Omura), Sun Mar 8 10:17:56 1987. A comment to message 399.

The Shift-left-mouse key has a slight problem in that it seems to have a cap limit of about 20 files that it can handle on one copy (I can't remember exactly - I just copy one row of icons at a time), but if you keep your folders to a reasonable size, you get the job done fairly quickly.

atari.st/software #401, from alexl (Alex Leavens), Tue Mar 10 15:55:20 1987. A comment to message 400.

There's no cap limit on Shift-left mouse, but you do have to be careful and click `_inside_` the icon exactly, or it trashes the whole group that you've built up and you have to start again. Big pain.

REEXECUTION WITHOUT RELOADING

atari.st/tech #1977, from ianl (Ian Lepore), Thu Apr 30 20:10:00 1987.

Has anyone here ever used the process-termination vector? It is rather sparsely documented. I need to know some basics about it:

What does the stack look like when it gets control? Super or user mode? Have files been closed, memory freed, yet? What's in the registers? Is it safe to mess with d0-d2, a0-a2? Can I make GEMDOS/BIOS/XBIOS calls before terminating or attempting to restart the application? Is this a global thing, or is it on a per-process basis? In other words, if a process installs this hook, should it then `Ptermres()` and deal with ALL following process terminations, or does the hook go away with the process that installs it, or should the process clean up the hook itself before exiting?

I have a lot more questions, but answers to one or more of these might give me a feeling of bravado; enough so at least to begin experimenting with it.

The thing that leads to all this, BTW, is that I'd like to load a process just once, then execute it multiple times without reloading it. I tried this with `Pexec()`, doing a "load only," then an "exec only," then trying to do the "exec only" again. Apparently, when the EXECed process terminates, it frees the memory allocated to it by the "load only," so that if the program does any `Malloc` calls (or even does an `Mfree` during its startup), you get bombs. Pity. The ideal ARCSHELL, to me, would load ARC.TTP just once, then execute it repeatedly without a reload.

atari.st/tech #1978, from sprung, Fri May 1 02:59:20 1987. A comment to message 1977.

The approach taken by the author of SPEAK.TOS was to JUST LOAD `stspeech.tos`, then patch in RTSs at the appropriate points and call the program by address, using the info in the basepage returned by JUST LOAD. I plan on using this method to access some code being written in C and assembler.

APPLE

This month's Apple section has two short threads: one on the often-seen-but-seldom-understood ProDOS Error 01, the other a very short solution to a common disk drive problem.

THE INFAMOUS PRODOS ERR 01

apple/language #530, from hmcintyre (Herb McIntyre), Wed Apr 8 20:59:07 1987.

Would someone mind informing me as to what ERR 01 is all about? The manual says to call your dealer. I did - he was no help.

apple/language #532, from mdavis (Morgan Davis, co-moderator), Thu Apr 9 05:33:46 1987. A comment to message 530.

INSERT SYSTEM DISK AND RESTART - ERR 01

... is the dreaded "unclaimed interrupt" error. One of your peripheral cards kicked the CPU, and there was no interrupt-service routine installed into ProDOS to handle it. I get this after using my printer in AppleWorks, leaving AppleWorks, and turning the printer off while in ProDOS BASIC, for example. -

CHAOS MANOR MAIL

Conducted by Jerry Pournelle

Now, an Atari Defense

Dear Jerry,

I don't want to start another fight. But I felt I had to respond to Ali Ozer's letter regarding the Amiga and Atari operating systems (Chaos Manor Mail, September, page 32). Mr. Ozer is woefully uninformed, as are many people, about the design of the Atari operating system. He appears to conclude that there is no good reason for the ease with which programs can be ported from MS-DOS to the ST, other than the fact that the ST is a primitive device that avoids the subtleties of a multitasking OS.

The fact is, several significant features of the ST promote porting from the IBM PC environment. The floppy disk format, file structure, and directory organization are virtually identical to that of MS-DOS, right down to the file-allocation tables (they are file-compatible out of the box, and full media compatibility is easily achieved). The high-level GEMDOS calls have the same identification numbers as their MS-DOS counterparts. The keyboards have most of the same key codes. Finally, the GEM implementation provides a particularly familiar environment for programmers who have used it on the IBM PC.

Back to multitasking for a moment. The ST does indeed have a time-slicing event manager. This is what allows me to have desk accessories such as text editors, terminal emulators, and alarm clocks available while I work on my spreadsheet concurrently—to say nothing of background tasks such as print spooling, smart-caching, and timed backups.

Is this "true" multitasking? No. The event manager is passive, not active, and it relies on the polite behavior of the various programs. And desk accessories are fundamentally, although not functionally, different than applications programs. Theoretically, I suppose you could download a YMODEM batch in one task, compile and link a megabyte of source code in another, and play chess in the foreground, provided the programs were all well behaved. Unfortunately, many are not—a problem not unique to the ST.

In any case, the facilities for time-slicing on the ST are significant and, from a programmer's point of view, easy to manage. The ST exceeds the Macin-

tosh in this one regard, and I hardly consider the Mac's OS to be primitive. Somehow, I think it will be a while before OS/2 gets out the door. But if multitasking is sorely needed, several alternative OS packages are available for the ST, some of which even support multiple terminals (e.g., Unix emulators, OS/9, and Micro-RTX). In summary, a programmer has no more business polling the keyboard in a loop on the ST than he or she does on the Amiga.

As to the 40-folder limitation, that subject has been beaten to death. This is a bug in the OS, hardly a design feature. The problem is in the number of folders accessed since boot-up; due to a garbage-collection strike in a sandwiched buffer, saturation can occur. I have about 70 folders on my hard disk, and I have never experienced the problem. But if I do, several public domain patches are available that cure the problem. I doubt if anyone would claim that the Amiga OS is bug-free, so we all just move on.

I agree wholeheartedly with Mr. Ozer that programmers need to invest more effort in writing applications that adapt to their environment, rather than the other way around. As operating systems become smarter, it will be easier for programmers to let them be the boss. For now, MS-DOS isn't there; even the Amiga isn't there. But the Mac, the ST, and the Amiga are all steps in the right direction.

Paul B. Loux
Denver, CO

You aren't starting a fight, and you've said it better than I could.—Jerry

More on Mac Clones

Dear Jerry,

I was intrigued by the letter in your August column from Richard H. Good-year (page 268) and his observation of the lack of a Macintosh clone on the market. His letter implied that business people have a personal dislike for the Macintosh computer and that this was the reason for the lack of a clone. This line of reasoning is faulty at best, and it perpetuates the misguided stereotype of the selfish business persona.

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Atari's Mega 4

Jim Kent

A new version of the ST with 4 megabytes of RAM and a graphics coprocessor

The Atari Mega 4 is an improved ST in a new box. Along with 4 megabytes of RAM, a blitter (bit-block transfer) chip, an expansion slot, and new ROMs, the Mega 4 has an 8-megahertz 68000 processor, an internal 760K-byte 3½-inch floppy disk drive, and a 10-megabyte hard disk drive/direct memory access port. It also comes with either a 640- by 400-pixel monochrome screen or (with the color monitor) a choice of 640 by 200 pixels in 4 colors or 320 by 200 pixels in 16 colors.

The Mega 4 uses the TOS operating system and the GEM Desktop ROM-based system software. With a color monitor, the Mega 4 costs \$2599.95. (See the box on page 154 for details on the different configurations and their prices.)

The Box

Except for its loud fan, the Mega 4's box with its detachable keyboard is a big improvement over the 1040ST. [Editor's note: See "The Atari 1040ST" by Dave Menconi in the February *BYTE*.] The monitor now sits on top of the system unit. The biggest improvement is the keyboard itself, which is laid out just like the 1040ST's but has a less spongy, cleaner action. The keyboard is attached to the CPU with a coiled phone cord that stretches to a length of about 8 feet. The footprint of the CPU and monitor is reasonably small, about 14 inches square. Overall, the packaging takes up considerably less desk space than the 1040ST does.

My review system came with an SH204 20-megabyte hard disk drive. This large, heavy disk drive's cable is so short that you can place the drive only to the left of or behind the machine. According to Atari, the new SH205 hard disk drive, which will be

available later this year, will fit underneath the Mega system box.

The Blitter

The most interesting new feature of the Mega 4 is the Atari blitter. This piece of custom silicon speeds up graphics operations, especially rectangle fills and moves, and text moves. Software that makes graphics calls through the GEM VDI or the Line A traps, or that uses BIOS calls for text, will speed up noticeably. [Editor's note: For more information on the GEM VDI and the Line A traps, see "Atari ST Software Development" by Michael Rothman in the September 1986 *BYTE*.] GEM-based programs, particularly First Word and the GEM Desktop itself, are more pleasant to use with the blitter.

The Atari blitter can perform the standard Boolean operations (e.g., move, or,

and, and xor) on a source and a destination bit map. More important, it can shift the source so the screen can be quickly scrolled one pixel at a time. It has a 16-word pattern mask for half-tones and patterns.

An esoteric but potentially powerful feature of this blitter is the smudge bit. When this bit is set, the blitter uses the four least-significant bits of the shifted source as an index into the pattern buffer. I've used this to create a full-screen $\times 4$ zoom in $\frac{1}{50}$ second, about twice as fast as it can be done with the 68000. [Editor's note: Source code (nonexecutable) listings for *scrollzoom.c* and *zoomblit.asm* in C and assembly language are available on BIX, on BYTEnet, on disk, and in the Quarterly Listings Supplement. See "Program Listings" in the table of contents. To "find" source code in the Listings areas on BIX and BYTEnet, search by article title, or author, or issue date. Some archived files may contain numerous listings for a single article. A description of the file also accompanies each entry.]

Normally, the blitter and the 68000 take turns of 64 bus cycles each. In hog mode, the blitter grabs all the cycles. However, this leaves the 68000 unavailable to service keyboard and other interrupts. You don't want to miss keyboard interrupts because you'll lose your type-ahead, so it's better to operate the blitter in shared-bus mode. The processor can restart the blitter early, before the 68000's 64 cycles are up. This gives the

continued

Jim Kent works at Dancing Flame and is the moderator of the atari.st conference on BIX. He can be reached at 739a 16th Ave., San Francisco, CA 94118 or on BIX as "jim_kent."



Atari Mega 4

Company

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Components

Processor: 8-MHz 68000; custom bit blitter graphics coprocessor
Memory: 4 megabytes of RAM (2 megabytes in the Mega 2); 196K bytes of ROM

Mass storage: Internal 720K-byte double-sided 3½-inch floppy disk drive; 10-MHz DMA port can be used to connect Atari 20-megabyte or third-party hard disk drives; port for additional external floppy disk drive

Display: Monochrome 640- by 400-pixel display with black-and-white monitor; color 640- by 200-pixel display in 4 colors or 320- by 200-pixel display in 16 colors out of 512 with color monitor. Screen uses 32,000 bytes and may be located on the start of any 256-byte page of memory.

Keyboard: 94-key IBM Selectric-style QWERTY keyboard with numeric keypad, cursor controls, and rhomboid function keys

Sound: Three independent sound channels with envelop/volume/frequency control

Expansion and ports: Internal expansion slot with full access to the 68000 bus; Centronics parallel port; DB-25 serial port with IBM PC pin-outs; MIDI in and MIDI out; 10-MHz DMA port for hard disk drive, laser printer, or other high-speed peripherals; mouse/joystick 0 port; joystick 1; 128K-byte external ROM cartridge slot

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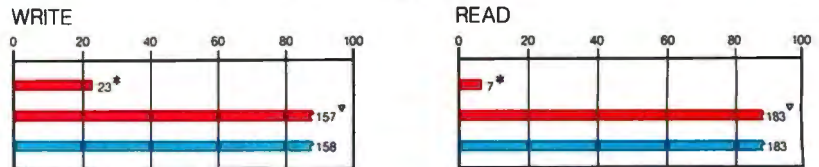
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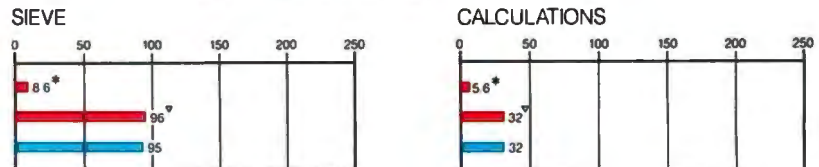
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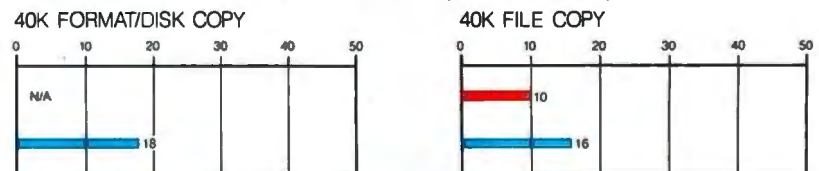
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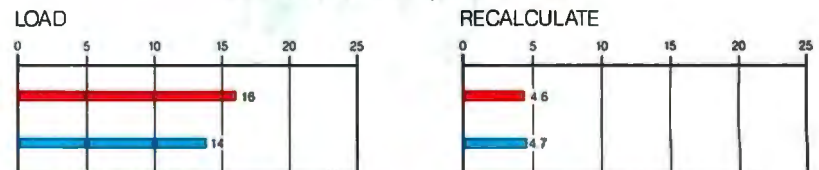
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■ ATARI MEGA ■ ATARI 1040ST
* TRUE BASIC
▽ ST BASIC

The Disk Access benchmarks write and then read a 64K-byte sequential text file to a hard disk. Sieve runs one iteration of the Sieve of Eratosthenes. Calculations performs 10,000 multiplication and division operations. The System Utilities graphs show how long it takes to format and copy a 40K-byte file using the system utilities. The Spreadsheet tests load and recalculate a 25-row by 25-column ACalC spreadsheet. The Atari ST tests were performed using TOS in ROM, Atari ST BASIC, and the ACalC spreadsheet. The Mega 4 tests were identical except for the addition of the True BASIC benchmarks.

68000 a chance to service interrupts every 64 memory cycles (256 processor cycles), while letting the blitter operate at about 90 percent of hog speed.

The blitter is controlled with 16 read/write registers. It can manipulate bit maps as large as 512K by 64K pixels anywhere within its 8-megabyte address space. In addition to the usual offset to be added to the screen address at the end of each line, the Mega 4's blitter has an offset to be added at

the end of each word. This is to cope with rendering single-bit-plane sources (such as text) onto the color screen, where adjacent words in a bit plane may be 4 and 8 bytes apart, depending on the resolution.

The ROMs and Slot

The Mega 4's new set of ROMs primarily provides support for the blitter. Rectangle drawing is significantly faster with the blitter enabled. Other graphics opera-

tions, such as line drawing, are faster because of better coding. Atari has also taken the opportunity to fix the RTS/CTS bug in the serial driver. (This bug caused the loss of characters when reading ASCII files from another computer through the modem port.)

TOS clears all free memory to zero when starting up a program. In the old ROMs, this was done inefficiently. The new ROMs start up a program on a -

REVIEW: ATARI'S MEGA 4

megabyte machine about 1 second faster than the old ones did on a 1-megabyte unit.

The ROMs haven't improved the file system; there's still a limit of 40 folders on a hard disk. However, Atari has distributed a program to increase this limit to 200 folders.

The Mega 4 has a single 64-pin expansion bus located inside the CPU unit. Essentially, it's a tap into the existing 68000 bus. This should be a boon to third-party hardware developers and custom hardware hackers, who previously had to content themselves with the cartridge slot.

System Performance and Reliability

I used the Mega 4 for about 2 weeks for software development. I replaced the GEM Desktop with a third-party Unix-like shell. A third-party disk cacher improved the speed of the hard disk drive. This, plus a copious RAM disk for intermediate files and a decent C compiler, cut my edit/compile/link times to less than 3 minutes on a 110K-byte application assembled from 95 source files. This compares favorably to using IBM PC ATs and some of the 68020-based workstations.

A significant feature of the Mega 4 and other ST systems is hardware memory protection. Memory protection increases system reliability by making it harder for one faulty piece of software to destroy the operating system. The protection hardware also makes it much easier to debug programs because it stops the program as soon as it addresses memory not available to it, and this is often the first sign of a bug. The lower 2K bytes of the system's memory map and anything past the end of RAM are protected. The Mega 4 lacks only multitasking to make it an ideal programming workstation.

To give a broader perspective on the BASIC benchmarks, I've included the results for True BASIC as well as for Atari's ST BASIC. True BASIC is 20 times faster than ST BASIC in some tests.

Atari is bundling less software with its systems these days. Gone are NEOchrome, Atari Logo, and First Word. All that's left is Atari's GEM-based ST BASIC. Fortunately, lots of good unbundled software runs as well or better on the Mega 4 than on the 1040ST, including ST Writer, CAD-3D, NEOchrome, DEGAS, DEGAS Elite, Aegis Animator, Flicker, Megamax C, Chat, and GFA BASIC. In fact, of the more than 50 programs and utilities that I use in a typical week, only one (a public domain terminal package) failed on the Mega 4.

A Satisfying Upgrade

In the Mega 4, Atari has brought us another 68000 box with a lot of memory. Even though there are significant differ-

continued

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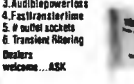
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ences between this model and the earlier 520STs and 1040STs, I was pleasantly surprised to find that most of my software and all my peripherals for the 520ST worked for the Mega 4 as well.

The Mega 4's box fits more neatly on my desk, and the keyboard is more ergonomic than that of previous ST machines. The blitter chip speeds up both graphics- and text-oriented applications significantly. Although the Megs are more expensive than the previous STs, ST owners will find them a satisfying upgrade path.

Once Atari's laser printer becomes

available (Atari promises it "by the end of the year"), the Mega 4 will be ideally suited to desktop-publishing applications. Moreover, as the PC world switches to 3½-inch floppy disk drives, an often overlooked fact about the ST family, including the Mega 4, becomes important: It can read and write to 3½-inch 760K-byte floppy disks formatted on an IBM. If you want the speed and programming ease of an 8-MHz 68000 and the benefits of crisp, fast graphics without being completely isolated from the PC mainstream, the Mega 4 is a viable option. ■

VIEWS FROM BIX: ATARI MEGA 4

atari.st/reviews #2, from Steven Grimm.

I have just two nitpicks for your otherwise excellent review. First, the 40-folder limit doesn't actually prevent you from having more than 40 folders on your system; it's the maximum number that can be accessed during one work session (i.e., between reboots). So, if you have 50 folders, 20 of which are for games and 30 of which are for programming, you'll probably never notice the limit at all.

atari.st/reviews #4, from Jim Omura.

I had a chance to use a Mega ST a few weeks ago, and Al Page noted that he thought the disk drive of the bare Mega is a tad low. If you tilt the keyboard up, it gets in the way of the slot and it's cumbersome to change disks. Anyway, we thought that if you stick the computer on top of the new hard disk drive, this problem would be alleviated. And then again, a couple of issues of BYTE can do this as well.

atari.st/reviews #14, from Tom Jeffries.

I would like it if the incredible size/power ratio was clear, but maybe you have to be there to see it. I sit in front of my tiny little Mega right next to this humongous XT clone that's at least five times as big, with 640K bytes and an 8088. It looks like a stone-age tool in comparison. One thing: You state that it is only possible to put the SH204 on the left side. Mine sits on the right side with no problem. There's no cord to spare, but it fits. Maybe they are shipping shorter cables with the SH204 now.

atari.st/reviews #17, from David Betz.

Yes, it is nice to have such a small machine with such a large amount of memory. Is there any chance that the price will drop before introduction? It doesn't seem reasonable to have to pay \$1200 extra for 3 megabytes of extra memory. The 1040ST costs less than \$1000 and is most of what the Mega 4 is except for the extra memory and blitter. Could those really cost \$1200? The blitter upgrade was only supposed to be around \$100, as I remember it.

atari.st/reviews #18, from Jim Omura.

Well, the Mega construction is definitely more expensive than the extra memory and blitter. Still, there does seem to be a "healthier profit margin."

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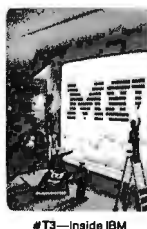
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place—and replace the smaller one that came with the machine. This takes less than half an hour. Then get a good hard disk drive kit. The best ones I've seen come from Priam, but plenty of others are out there. Install the hard disk drive. Then add the Sota MotherCard. The result will be fast, and it's a lot cheaper than buying a new AT. Recommended.

Sota also has a 386 card to put into your AT compatible. This thing runs so fast I could hardly believe it: In one benchmark, the Compaq 386 scored a rating of 3.5 versus a normal IBM AT's 1.0; an AT with the Sota 386 card ran at 5.6! The Norton SI (system information) rating was 31.6, which is actually as high as that index can go. I confess I am anxiously awaiting that card.

Atari Mega ST

Atari intends to go after the U.S. business market in a big way. The company is already accepted as a leader by the European business community. The original 520ST and 1040ST machines give more bang for the buck than anything else I'm aware of.

Given David Small's Magic Sac (and the Atari monochrome screen), you can make any ST run most (older) Macintosh software. Data Pacific also has a new Translator box that lets you run Macintosh software directly from its original disks. Meanwhile, there's plenty of business software being developed for the ST itself.

There are word-processing programs like Regent Word, and if you're used to WordPerfect, the Atari ST version runs as you'd expect it to. A lot of software runs better on the ST than on PCompatibles, because the Atari handles graphics better, and some programs are just easier to use with the GEM interface than with PC-DOS. A good example is Zoomracks, a data-storage-and-retrieval program that emulates the older card-based Execu-Scan system I formerly used. Zoomracks has a lot of similarities to HyperCard and positively cries for a mouse.

The Atari's monochrome resolution (640 by 400 pixels) is better than the Macintosh's, and it has a larger screen to boot. The Atari's color in "medium resolution" is the same as the IBM PC's CGA (see table 1), but the system hardware allows clever tricks to get a lot more colors onto the screen.

Antic has a program called Spectrum that does unbelievable things to Atari color, making it hard to distinguish it from the Amiga. The Atari 520ST and 1040ST machines sell at attractively low prices. In a word, the Atari ST line has a lot going for it.

The Mega ST is Atari's new and improved version of the ST. You can get 2 or 4 megabytes of memory, which is twice the Macintosh SE's capacity. If you get a Mega ST, the Mega 4 is probably what you ought to buy; it's pretty hard to upgrade the Mega 2 into a 4. I know of no programs that can use the full 4 megabytes, except Antic's Cyber family of three-dimensional CAD and animation software, which turns the Mega ST into a desktop video workstation. They do things little short of amazing.

Unlike programs that run under PC-DOS, there's no inherent reason why an Atari ST program can't be a megabyte in size and access another 3 megabytes of data. The Mega ST also has a blitter chip to speed up graphics. The resulting color output isn't quite up to the standards of the Amiga, but it's sure good enough for most people. I've just put in the best part of a week playing with the Mega ST, and I like it.

There are real problems, though.

First, it's overpriced. By the time you get a Mega 4 with a hard disk drive, you'll have paid nearly as much as you would for the Macintosh SE, and there's a lot of Macintosh software out there. Up to now, Jack Tramiel's Atari machines have been competitive in price and performance; I'm not so sure that's true of the Mega ST.

There are also compatibility problems.

continued

Table 1: Standards supported by the Orchid TurboPGA board. Emulation of CGA, MDA, and HGC is achieved through software commands; PGA and EGA are native to the hardware.

Name	Resolution	Colors	Palette	Horizontal scan	Vertical scan
PGA	640 x 400	256	262,144	30.5 kHz	60 Hz
EGA	640 x 350	16	64	21.8 kHz	60 Hz
CGA	640 x 200	4	16	15.75 kHz	60 Hz
—	320 x 200	—	—	—	—
MDA	720 x 348	—	—	—	—
—	80 x 25 characters	(mono)	—	18.4 kHz	50 Hz
HGC	720 x 348	(mono)	—	18.4 kHz	50 Hz

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CHAOS MANOR

Some of the software written for the 520ST and 1040ST blows up on the Mega ST. As an example, Strategic Simulations' Roadwar Europa is not copy-protected and instructs you to play only with a copy. Fine, but when I formatted a double-sided 3 1/2-inch disk, I kept getting bombs (the Atari's rather whimsical system failure message) at disk access.

I finally erased that disk and reformatted it as single-sided, after which I got fewer bombs—but it still crashed several times during the course of the game. MichTron's M Disk program doesn't seem to find all the extra RAM in the Mega ST. It will still let you make a big RAM disk. I've had glitches with some other programs (mostly games; games are a pretty good way to test a machine).

The Mega ST has a new version of the Atari ROM TOS operating system. It fixes some bugs in the old TOS; for example, the 520ST and 1040ST used to forgive writing beyond the end of memory, while the Mega ST sees that as a bus error. Unfortunately, although it isn't the machine's fault (programmers have no business being that sloppy), this and other "fixes" introduce more incompatibilities with the 520ST and 1040ST.

I don't want to exaggerate. Well-written software has no compatibility problems, and most of the older stuff will be fixed in new versions. The real problem with the Mega ST isn't its compatibility, but its price.

Education and the Atari ST

When you think of computers in education, you naturally think of Apple; but in fact there's an awful lot of good stuff out there for the Atari ST. Arrakis Advantage has designed a whole series of programs to teach subjects like statistics. They use computer graphics in a very clever way to hold the student's interest.

MichTron has a whole line of ST software, from desktop utilities like M Disk and MichTron STuff that almost everyone will need, to games—Time Bandit still has my vote as having the most exciting graphics I've seen on a small computer game—to educational programs like AB Zoo, which teaches keyboarding to children ages 3 to 6.

Mrs. Pournelle spent an hour playing with AB Zoo and kept calling me over to look at the graphics. Her favorite was the little vampire bat that pops up when you correctly find the V key. We did get a bit weary of the music; there are only three tunes, and after 10 minutes of "Twinkle, Twinkle, Little Star," you wish mightily for a nova. Of course, you can always turn the sound off.

A more advanced educational game is

continued

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Invasion, also published by MichTron. This game is similar to Type Attack in that you see a city, with words falling onto it; as you type the letters in the words, a laser shoots them off the screen. You're supposed to get them all before a building is hit, and the only way you'll do that at the faster levels is to learn touch-typing. There's no way you can stare at the keyboard.

We found a glitch in this game, in that it wouldn't let us create a new typing practice vocabulary although it said it would; we got cherry bombs on both the

Mega ST and the 1040ST when we tried to save the new file, and once again I think it was because we formatted the playing disk as double-sided. It's not a critical problem; since the program expects the new vocabulary to be in a standard ASCII file, you could actually create one with any word processor.

Invasion also has a math section: The enemy attacking your city is an equation like " $3 + 5 = ??$ " or " $4 * 7 = ??$ ". You're supposed to type all of it in, not just the right answer. The constant repetition tends to burn the addition and times

tables into your brain all right; the problem is that on the Atari ST keyboard, you have to use Shift keys to produce the + and * signs and so forth, and that's not easy given the time you have before the enemy blows up part of your city. Alas, you can't make up your own equations; Mrs. Pournelle thinks she could do some better ones. For the price, though, Invasion is quite a bargain.

That brings us to Walt Disney Personal Computer Software from Sierra On-Line, specifically Donald Duck's Playground. This says it's for ages 7 to 11, which is silly; I'd expect 4-year-olds to like it, and kids over age 9 might tire of it fairly soon.

The game was ported over from the IBM PC by a programmer who didn't understand the Atari ST. In order to play it, you must plug the mouse into the Atari ST, then, after the program boots up, unplug the mouse and put the joystick into the place the mouse was. Given that on the Atari ST the mouse and joystick ports are under the machine, this is one miserable task. There are separate ports, and you can keep both the mouse and the joystick plugged into the Atari ST; but Sierra On-Line didn't bother studying the machine and requires that the joystick be in port 0, where the mouse usually resides.

Once you get the game up and running, though, it's pretty cute. Donald Duck wants to buy equipment for a playground. First, he has to earn money by working in a series of amusing if a bit tedious tasks. Then he can go buy things, paying for them and making change as required. Finally, he can go inspect the new equipment that has been delivered to the playground and watch his nephews jump, slide, and otherwise enjoy themselves.

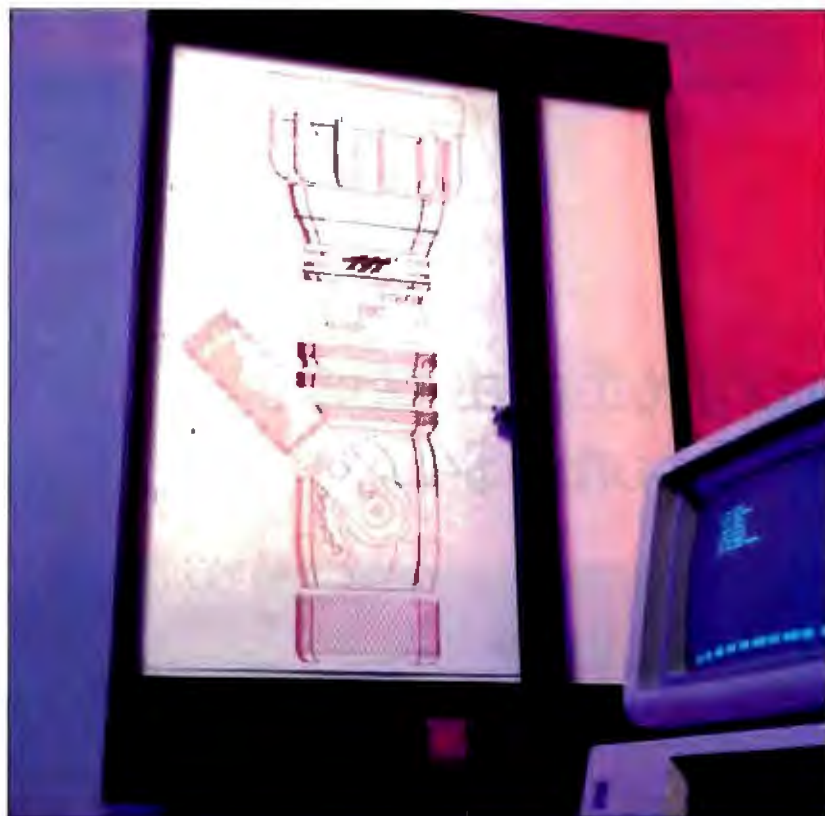
I can't guarantee how long it will hold a 7-year-old's attention, but it kept Mrs. Pournelle and me amused for hours.

Language Up

Given what you get for the money, I don't think there's a better home/educational computer bargain than the Atari 520ST. The question is, how will Atari fare in the business machine market?

The machines are technically good enough. There are some drawbacks. I've already mentioned price. The Mega ST has a detached keyboard and a more professional look than the original STs, but, alas, the Mega ST still has those "designer" function keys slanted to look just as cute as a bug's ear while making it hard to use them properly. The mouse and joystick still plug in awkwardly, and there's only the one serial port. No internal modem and no slot. No math chip. Some of these limits may be overcome by

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Atari uses Digital Research's GEM as the main user interface. I could learn to prefer GEM to DOS, and many already do. My pet peeve is that the silly drop-down menus drop whenever the cursor gets too close to the top of the screen; but there is, I'm told, a memory-resident program that fixes that, so that you have to click to get the menu. (GEM originally had pull-down menus like Xerox, Lillith, and Macintosh, but Digital Research was frightened away by lawyers.)

There are signs that the software is coming. I saw a lot of it at COMDEX. I

Barry Workman and my son Alex of Workman and Associates demonstrated their new FTL Modula-2 compiler for the Atari ST at COMDEX. There hasn't been a lot of applications software written in Modula-2 in the IBM PC world. There are several reasons for this. One big one, I think, is Turbo Pascal, which has had so many features added that it's more like Modula-2 than Pascal anyway.

In my judgment, Modula-2 is still the language of choice for most large projects, particularly in situations where a number of programmers have to work more or less independently. Workman's version for the Atari ST is set up to work with GEM, and the optional Editor Toolbox gives source code for writing your own applications.

FTL Modula-2 produces code that runs acceptably fast on the ST: a Modula-2 version of my very math-intensive matrix benchmark (see the August 1987 BYTE, page 243) runs in 63 seconds on the ST. Typical times on a Zenith Z-248 without a math chip are about 80 seconds. I'll be much surprised if there aren't several Atari ST applications programs written in FTL Modula-2 by this time next year.

There's also HiSoft BASIC, which is "interactive compiled." It's fast (running my benchmark in about 60 seconds) and reasonably compatible with Microsoft Compiled BASIC 3.0 for the IBM PC. (It doesn't have records and some of the features of Microsoft QuickBASIC 4.0, but then nothing else does either.)

HiSoft BASIC supports recursion and has libraries for interfacing with GEM. It's powerful enough to write business applications with. I'm still doing all my accounting with programs I wrote in 1978 in Compiling CBASIC (originally CP/M, later recompiled for PCompatisbles), and HiSoft BASIC for the Atari ST is as powerful as CBASIC was.

I'm told there's a Prolog for the Atari ST, but I haven't seen it yet. I sure would like to. Then there's Lisp.

John McCarthy wrote Lisp (officially, that stands for list processing, although Lisp detractors say it stands for lots of insane stupid parentheses) while a graduate student in the 1950s. It has since become the language of choice for much of the artificial intelligence community, largely because Lisp doesn't see any differences between data and program. That makes it easy to write programs that modify themselves. Of course, once you've done *that* you could end up with a smart program, but unless you're pretty smart, you'll probably generate a colossal mess.

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CHAOS MANOR

Some extremely interesting programs are written in Lisp. Many were developed at universities with public money and thus ought to be in the public domain. Some are perhaps obsolete: The first spelling-checker program I ever used was developed at MIT for the DEC PDP-10. I thought it wonderful at the time, but there are much better ones now. Others, like MACSYMA, which does symbolic algebra, have enormous potential.

Lisp is a memory hog. It has to be, since it does a lot of its work by recursion (a technique in which a function repeatedly calls itself). John McCarthy used to be fond of saying that Lisp doesn't really get interesting until you have a fast machine with 4 megabytes of memory.

The Atari ST is a fast machine that can have 4 megabytes of memory. I know of only two Lisp programs for the ST: Metacomco's Cambridge Lisp and a program written by BIX Senior Editor Dave Betz ("dbetz" on BIX). Both are limited. I'd sure be interested in seeing a good MacLisp or some such for the ST.

A Picture of the Future

When IBM brought out the PC, they deliberately didn't build in video hardware. You had to buy a card that would output either monochrome or color graphics. This was pretty clever given the advances that were (and still are) being made in video display technology, but it sure made for confusion since there was no real standard.

About the same time, Zenith put both RGB and composite color in their machines, with the latter able to drive a monochrome screen as well. They still do that on their laptops. The color on the Z-100 dual-processor machine was better than anything IBM had for quite a long time, just as the Z-100 was a better machine than the IBM PC. It didn't have a detached keyboard and had some other minor problems, all of which would have been fixed, but the Z-100, like a lot of other good machines, was burned up in the mad race to PC compatibility.

IBM's monochrome and color weren't very good, and it wasn't long until third parties like Paradise, Orchid, and Hercules brought out improved video boards with far better graphics capabilities. However, none of the early PC-compatible color capabilities were good enough for writing books. The edges of the letters were too fuzzy, and the whole display lacked crispness. For serious writing, you had to stay with monochrome or avoid the PC-compatibles altogether.

Then came EGA, which required a monitor with a higher sweep frequency, and at first there were problems running software written for the older IBM CGA

standard. The monitors and EGA driver boards weren't cheap, but EGA was certainly good enough for professional writers. For that matter, it still is. I'm still using it for all my writing, including this column. EGA was responsible for bringing a number of writers into the PC-compatible fold.

The problem was that EGA boards weren't well-designed. The chips don't have readable registers, which means that although your software has to be written to take advantage of EGA, the program can't get feedback: there's no way to tell what state the EGA board is in. That can lead to some odd displays. Faults and all, though, EGA was good enough that it became the business color standard, and a lot of companies began producing EGA monitors.

It was a short-lived standard. I don't suppose we can say EGA has actually been replaced, but we can all see the handwriting on the wall. When IBM announced VGA, the new "standard" for the PS/2 bus, they didn't say they were abandoning EGA, but they didn't say they were going to support it, thereby in effect pronouncing EGA's death sentence. In a few years, many expensive EGA monitors are going to be somewhat obsolete. It's a pity they can't be modified so they can be used with the new VGA graphics, but they can't.

Notice that I said "obsolete" and not "surplus." Readers of this column will recall that for a year now I've been using an EGA system with Intecolor's MegaTrend 19-inch EGA monitor. I still love it. That monitor is more than good enough for just about everything I want to do, and EGA will continue to be good enough for what people bought it for. However, graphics technology moves on, and I'm interested in keeping up.

Electrohome and TurboPGA

The upshot is that I have a new monitor, an Electrohome ECM Vari-Scan. This accepts everything from CGA up through the new PGA systems. Like the NEC MultiSync monitor, the ECM Vari-Scan accommodates just about everything you throw at it.

Surprisingly, the monitor is slightly smaller—though heavier—than the MegaTrend. In EGA mode, the screen quality is comparable to the MegaTrend's; my subjective opinion is that the MegaTrend's display is crisper and the colors a bit more vivid, but there's not that much difference.

In PGA mode, this thing is gorgeous. We're driving it with the Orchid TurboPGA board. This board, like the Electrohome monitor, accepts all inputs from

continued

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Wizard's Crown.....\$39.95
 SSI
 1046 Rengstorff Ave.
 Mountain View, CA 94043
 (415) 964-1353
Inquiry 954.

sion, but there are others). If you're a baseball nut, the only problem the game has is that you'll spend half your life playing it. I know my kids have. If you're interested in hit-and-run, when to bunt, and that sort of thing, you can painlessly learn more about baseball strategy from Earl Weaver Baseball than from a dozen books on the subject. Recommended for baseball fanatics.

My personal game of the month is Wizard's Crown from SSI for PCompatibles. This is a sword and sorcery adven-

ture game that has really nice combat resolution—you can play down to a blow-by-blow battle—with good CGA graphics and an interesting adventure quest with puzzles.

The book of the month is *From C to Modula-2 and Back: Bridging the Language Gap* by Claude Wiatrowski and Richard S. Wiener (John Wiley and Sons, 1987). This thing gets technical in spots, but if you know either language and want to know about the other, this is the book to get.

Now if I can just find a place to put all this unreviewed stuff. ■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerry."

MICROBYTES

*Staff-written highlights of developments
in technology and the microcomputer industry*

Device Could Break the Chains Between Portables and Batteries

A new device that converts RF energy into DC is capable of powering small electronic devices, such as laptop computers, and could free portables from "battery bondage." "Using this device, you'll never need batteries for your laptop again," Sonic Electric Energy Corp. president Ray Weilage told Microbytes. He said the company has been showing a "prototype RF-powered computer" at its headquarters in Atlanta.

According to Rick English, technical analyst for Prudential-Bache, "Sonic's patent for the RF conversion device has been approved. They have a lock on the technology."

Weilage said Sonic has successfully shown the device is capable of powering small color TV sets and other little units, such as portable radios. "However, the expansion of the technology into computers and television sets opens a new field for making these units portable and power-source self-sufficient," he said.

"We have a cell that converts radio frequency to direct current under 66

MHz. That's on the other end of the spectrum from NASA's experiments with microwaves to power an airplane type of thing. We're on the other end of the spectrum working with the longer wavelengths," Weilage said.

The actual device is "very similar to the photoelectric cells that convert light to energy. It's the same thing, except that we're converting radio frequency to energy," Weilage said.

To power a laptop computer would take a box about the size of a pack of cigarettes. Weilage said the unit would add virtually no weight to a laptop and would cost a manufacturer "about \$20."

The Sonic device draws the RF frequency from an antenna based on the Tesla coil theory. The efficiency of the device, Weilage claimed, stems from having reduced the Tesla coil to a microchip. "Bell Labs was the first to implement the Tesla coil technology on a microchip," said English, "but they were using it for a 'what if we could do this' type of experiment."

"DRAM Scam": Atari Chief Slams Shortage

America's computer industry is starved for computer chips, Japanese semiconductor firms are raking in the profits, and Atari CEO Jack Tramiel thinks it's all a scam—"the DRAM Scam," he calls it.

Tramiel used a press conference at the CeBIT '88 computer exhibition in West Germany to assail the "short-sighted and underhanded" trade policy of the U.S. and to denounce the "so-called DRAM shortage." He claimed there is plenty of chip manufacturing capacity in the world; however, because of trade agreements between Japan and the U.S., the supply can't match the demand.

"This is a case of calculated shortage," said Tramiel; the trade policy has foisted a classic manifestation of the Law of Unintended Consequences on the computer industry. A trade sanction against Japanese chip makers, intended

to stop the "dumping" of low-cost chips on the American market while allowing the survival of the U.S. chip industry, has backfired, he said. As a result, there's a shortage of dynamic RAM chips and a dramatic increase in their price, which in turn has meant higher prices for computers.

Nine months ago, DRAMs sold for \$1.50. "Today on the spot market, those same chips cost \$6," Tramiel said. "That's not profit. That's robbery." The current world demand for DRAMs runs around 100 million per month, according to Tramiel; the total U.S. output is only 10 million. "It didn't take the Japanese long to figure out that they could get a higher price for selling fewer chips. They don't mind profiting from America's stupidity."

Tramiel wasn't totally negative. "I don't see this chip shortage lasting more

continued

Nanobytes

- The hottest thing our traveling news hand saw at the massive Hannover Fair in West Germany—or at least it was treated as if it was the hottest thing—was a Macintosh 512K-byte clone. Representatives of a Taiwanese manufacturer had brought the illicit box to show to a select few. The fact that it used illegal copies of the Mac ROMs made the reps a little secretive. "We are not certain that Apple can maintain its grip on the technology," one of them said. "We feel it is a possible violation of U.S. antitrust laws." Asked what such a clone might sell for, the spokesperson said, "We would like to see the computer sell for around \$795."

- Although some expect the shortage of memory chips to lighten up soon, computer makers are wrangling to get memory wherever they can. We've heard that certain Japanese semiconductor companies have been quietly distributing 4-megabit dynamic RAM chips to select customers. The DRAM shipments are invoiced "test samples" or "research samples," which could indicate that the chips are being offered in advance of actual production quantities. Japanese firms are increasing their outputs of dynamic RAMs; analysts say the few U.S. companies that supply DRAMs had better do the same.

- MIPS Computer Systems (Sunnyvale, CA) claims "sustained performance" of 20 VAX MIPS with its new RISC processor, the R3000, which is about three times the claimed processing power of Sun's SPARC chip. The 25-MHz chip will be supplied by Integrated Device Technology, LSI Logic, and Performance Semiconductor. Perhaps as important as MIPS's new chip is its agreement with AT&T to de-

continued

velop an application binary interface (ABI) that will allow binary compatibility of Unix applications across all systems using MIPS processors. MIPS spokespersons claimed the AT&T deal sets them on equal status with Sun's SPARC architecture in relation to Unix. However, Sun will jointly develop Release V of Unix System V with AT&T.

• **Tandy** (Fort Worth, TX) is now licensing its easy-to-comprehend **DeskMate interface** to developers. DeskMate is a pictorial interface that works on 8088, 8086, and 80286 computers. It takes up only 384K bytes of memory. Some of the software publishers saying they'll write for the environment include Symantec, Electronic Arts, Broderbund, Intuit, Sierra Online, Software Publishing Corp., and Activision. Tandy marketing director Ed Juge said that because DeskMate is so easy to use, it will help sell "a ton of computers."

• **Epson America** (Torrance, CA) cut the suggested price of its Equity III+ computer with a hard disk drive by \$196 to \$3299 and the floppy disk drive version by \$96 to \$2199. The bad news is that the price of the LQ line of 24-pin printers went up (except for the LQ-2500): the LS-500 went up \$30 to \$529, the LQ-850 up \$50 to \$849, and the LQ-1050 up \$100 to \$1199.

• **G-2 Inc.** (Milpitas, CA) has gotten into the growing IBM-compatible business with three new products: a chipset compatible with IBM's PC XT and PS/2 Model 30 and supporting clock speeds up to 10 MHz, a VGA chip, and a trio of chips that G-2 says "replaces most of the ICs" used to build AT compatibles and systems based on the 80386. Samples are ready now.

• **U.S. companies will spend \$20 billion on software** and related services this year, a new report claims. Based on interviews with 137 Fortune 500 companies, Newton-Evans Research (Ellicott City, MD) says packaged software will account for about \$12.5 billion of that sum. The researchers say that 350,000 Americans are working in software-development jobs.

continued

than 6 or 9 months," he said. He also announced that Atari hopes to either buy or build its own semiconductor plant within the next 12 months.

Atari will hold the line on the prices of its systems, Tramiel said. (Atari is reportedly currently buying chips, under contract, from Japanese manufacturers for \$2.50 each.) "So maybe we only make \$55 million next year instead of \$57 million," he told an applauding European audience. Europe receives the largest share of Atari's computer output.

Regardless of its causes, the current shortage of DRAM chips is preventing Atari from manufacturing enough Mega STs to supply the U.S. market, company marketing director Neil Harris said.

Because of Atari's popularity in Europe, most machines, which are manufactured in Taiwan, are being delivered to European customers. Atari has held back advertising and marketing of the

Mega ST on this side of the Atlantic, Harris said.

The shortage of Mega STs in the U.S. has also put a damper on Atari's laser printer, which depends on the large memory capacity of the Mega ST for effective performance. Unlike most other laser printers, the Atari unit has no internal memory of its own but uses part of the Mega ST's 4 megabytes of RAM, which is actually a more efficient and cost-effective use of memory capacity, according to Harris.

Atari continues to delay production of its MS-DOS computer, announced more than a year ago. "It came down to a choice between manufacturing STs or MS-DOS machines," said Harris. "The MS-DOS machine is ready to go but won't go into production until the RAM shortage goes away." Harris said that Atari expects the DRAM shortage to start easing by the third quarter of this year and still has plans to aggressively market the Mega ST in the U.S.

Motorola Pushing 88000 as Chip of the Nineties

Motorola has established its 68000 as one of the powerhouse processors in the microcomputer market. Now the company's Microprocessor Products Group (Austin, TX) is aiming for similar success with the 88000, its 32-bit reduced-instruction-set computer (RISC) processor. The 88000 is based on a Harvard-style computer architecture, with separate address and data lines for a program's code and data. These dual "paths" allow code and data operations to operate in parallel, which improves throughput.

The 88000 is composed of three chips: the MC88000 central processor and two MC88200 cache/memory management units (CMMUs) that supervise the code and the data paths. The MC88000 has a register file of thirty-two 32-bit registers, built-in integer and floating-point math units, an extensible instruction set, and an extensible architecture. The extensible architecture is made up of eight special function units (one is the floating-point math unit) with 256 reserved op codes that allow a vendor to expand the MC88000's capabilities. Such expansions might include transcendental function support or a serial driver. The MC88200 CMMU has a built-in 16K-byte memory cache and performs bus snooping to maintain cache coherence.

A scoreboarding function in the MC88000 maintains validity of the register file contents. For example, if a multiply operation uses two register

values, and the contents of one of the registers is invalid (perhaps the fetch instruction loading the target register is still in progress), the scoreboard will stop the multiply operation until the fetch operation is completed. Scoreboarding lets software designers write RISC software without becoming mired in the details of moving data through the processor. It also allows certain code optimizations to be performed. Programs written for the 88000 are typically 10 percent larger or smaller than equivalent programs written in MC68020 code, according to Motorola officials.

From the beginning, both the MC88000 and the MC88200 were designed to support tightly coupled multiprocessing. You can use up to four MC88000s in parallel to boost processing power, or, if your application demands it, you can combine up to four MC88200s on a path to expand the path's memory cache to 64K bytes (128K bytes total). A single 20-MHz 88000 processor runs at about 15 to 17 million instructions per second and 34,000 Dhrystones. Motorola offers boards with combinations of one, two, and four 88000 processors.

In what's shaping up as a trend, companies are bringing out support tools with their new chips rather than just saying, "Here's the silicon, baby; you're on your own." For the 88000, there's an optimizing C compiler from Green-

continued

- C++ is now available for workstations from Apollo Computer (Chelmsford, MA). Apollo's version of the object-oriented programming language, called Domain/C++, is based on AT&T's C++ translator. The company intends to integrate the language with its Distributed Debugging Environment later this year.

- Since many IBM-compatible computers have high-resolution EGA or VGA monitors, the company known for bringing graphics to monochrome PCs, Hercules Computer Technology (Berkeley, CA), has had to turn to other areas of the graphics market. Hercules is working on several products for enhancing the performance of VGA-based machines such as the IBM PS/2. The firm is also developing similar products for the Macintosh II.

The VGA package will coexist with an existing VGA board, connected via the VGA card's feature connector. It will allow you to use Hercules' RamFonts on a VGA system and will also "improve the performance of current bit-mapped graphics applications," according to Hercules CEO Jim Harris. Hercules hopes to show the VGA board at Fall COMDEX, with a Macintosh version following close behind.

- Saba Technologies (Beaverton, OR) has retooled its Page Reader scanner to handle draft type from dot-matrix printers and to be a little faster at reading pages (about one per minute, the company says). The \$1299 Page Reader 2.0 also now supports the Tag Image File Format, which means the graphics can be used in PageMaker and other programs that accept TIFF files.

- The Computer Security Institute will demonstrate viruses and virus detectors at its conference for users of IBM and DEC systems. The program will emphasize network security, with sessions covering Ethernet and MacVAX networks. The event happens this month (June 13-15) in Arlington, VA. For more information, phone Irene at (617) 393-2600.

- The market for used microcomputers has reached \$1.2 bil-

continued

hill, with FORTRAN, Pascal, Lisp, and Prolog languages available in mid-1988, and COBOL and Ada languages available in the second half of 1988. Tektronix has its DAS 9200 logic analyzer with a MC88000 probe for hardware prototyping and testing. Phoenix Technologies and Insignia Solutions announced programs to allow MS-DOS applications to run on the 88000.

U.S. Firms Show Workstations Overseas

Although Atari and Commodore are known in the U.S. primarily for their low-cost home computers, both companies continue to work at high-performance machines. At the recent Hannover Fair in West Germany, they talked about their Transputer-based systems and Unix boxes that are in the works.

Atari demonstrated prototypes of its system based on the INMOS Transputer, the Abaq, at COMDEX in November. The company will ship "about 100 Transputers to developers in the next month," president Sam Tramiel told us at Hannover.

Commodore also announced its own Transputer-driven system. The company claims a processing rate about 10 times faster than an IBM PC AT. Each chip has four high-speed serial connections in addition to a normal bus. Four additional Transputers can be connected to the main processor.

Commodore is developing its system with a large-scale research institution, Gesellschaft für Biotechnologische (the Society for Biotechnology Research). Commodore plans to develop a high-performance workstation around the Transputer for use primarily in lab-

Anticipated uses for the 88000 include large-scale parallel processing projects, big banking systems, AI workstations that use three-dimensional graphics, CAD systems manipulating three-dimensional objects, and jobs (such as in aerospace) that demand fault-tolerant computing. Tektronix has said it will incorporate the 88000 in color graphics workstations.

oratories and industries. This project is based on the Amiga 2000, which, when equipped with the Transputer system, offers a greatly enhanced graphics capability for such applications as modeling molecular structures.

Atari showed us a prototype of a Unix workstation. The system, when available, would be shipped with Unix System V version 3.1, according to Shiraz Shivji, Atari's head of research and development. However, the working unit that we saw demonstrated was a wire-wrapped prototype. Shivji said the actual boards are now being manufactured and that Atari will begin shipping systems to developers in "two or three months."

The workstation will have at least 4 megabytes of RAM, use a VME bus, and support Sun's Network File Structure. The system is based on the 68030 chip. It will use the International Standards Organization model for networking, have a SCSI port, and use X-Windows, Shivji said.

Commodore is also developing a Unix workstation. The Commodore model is based on the 68020 chip and will first appear as an add-on board for the Amiga 2000.

Mac the Mouth Shows How We Speak

You speak into a microphone. On the screen of a Mac II, you see a cross-sectional animated diagram of a person's head. As you speak, you see the lips, the teeth, and the tongue move in sync with your voice. You think to yourself, "Gee, I didn't know my tongue moved so much."

What makes this animation possible is a program under development by a small San Diego firm called Emerson & Stern. The primary purpose of the program, informally called Mac the Mouth, is to help people who have speech difficulties.

According to Jan Zimmerman, the CEO of the company, the program will help speech pathologists to correct

speech problems that may be caused by hearing impairments, stroke, or head injury. It may also help people who want to lose their accent or develop a different one.

Mac the Mouth works by digitizing the sounds that a person makes when he or she says a word and breaking them down into a series of frequencies, similar to a standard spectrogram. The program then translates these sounds into an animated diagram of a person's mouth. The effect is almost that of being able to look into someone's mouth and watch his or her tongue move.

The program will allow people with speech impairments to have visual feed-

continued

A Personal Transputer

The prototype Atari Abaq, with the Helios operating system, could put a Transputer on your desk



he Atari Abaq is the first of a new breed of computers built around the INMOS Transputer chip, a high-performance 32-bit processor with a unique communications-based architecture designed for parallel processing systems.

Since its launch in 1984, the most common application for the Transputer has been in the "personal supercomputer," an array of Transputers acting as a powerful calculating engine, with a conventional computer acting as a frontend and supplying disk and display services through a conventional operating system such as Unix or PC-DOS. For this type of work, and in embedded control applications, Transputer programs (usually written in the Occam language) run on the bare hardware, with no intervening operating system to provide standardized services.

Beyond the personal supercomputer arena, the lack of a standard operating system that runs on the Transputer itself has become an obstacle to its wider adoption. The Transputer has a totally new architecture and instruction set: on-chip static RAM in place of registers, a hardware stack for expression evaluation and a 4-gigabyte linear address space with no memory management. (See "The DSI Transputer Development System" by John Poplett and Rob Kurver in the February BYTE.) Because of these new features, industry-standard operating systems would need to be completely rewritten for the Transputer. More importantly though, no existing operating systems have the characteristics to make full use of the Transputer's power.

Existing multitasking/multiuser operating systems (e.g., Unix and its relatives) were originally developed on minicomputers and expect to see a single CPU that runs multiple tasks by time-slicing in a shared memory space. The Transputer was designed with an altogether different model of computing—one in which different processes run on different processors with separate memory spaces.

This model is more like a local-area network of machines, in which different tasks can be distributed to different workstations. Extensive efforts are being made to produce versions of Unix in which the kernel can be distributed over many processors, but no such version is in widespread use yet.

The job of providing a new sort of operating system for the Transputer is now approaching completion, spurred on by Atari's announcement of the Abaq at the Fall 1987 COMDEX. The new operating system is called Helios and is being written by Perihelion Software Ltd. of Cambridge, England. Perihelion Software is run by Tim King, late of Metacomco, developer of

AmigaDOS for the Commodore Amiga. Helios is a general-purpose operating system for Transputer systems, and although Atari is an important customer for Helios, there are several others, including the graphics supercomputer firm, Meiko.

Transputer-Powered Graphics Workstation

"Abaq" is a Hebrew word meaning "from the sands" (suggesting silicon), and the root from which "abacus" is derived. The Atari Abaq was developed by Perihelion Ltd. (sister to Perihelion Software) and is due to be launched in September. [Editor's note: *Because a Belgian firm has prior rights to the name Abaq, it is likely that Atari will have to find a new name before the September release.*] It is a Transputer-powered graphics workstation that, at least in its first iteration, uses an Atari Mega ST as an I/O processor. At the time of this writing, it exists only as a board-level prototype. The basic machine will be powered by a single T800-20 floating-point Transputer, but more Transputers can be added in groups of four by inserting cards into expansion slots (three on the prototypes, but probably four in the final design).

At present, two versions of the Abaq are being planned. One is an add-on for an existing Atari Mega ST; the other is a stand-alone computer containing an ST motherboard. Both share the same technical specifications.

Because Atari doesn't provide the necessary expansion slots, the add-on unit will require the ST to be dismantled to gain access to the expansion bus on its motherboard, resulting in twin boxes and twin power supplies. The stand-alone machine will be housed in a single box with a footprint similar to the Mega ST's,

continued



"Charity" blitter chip assists graphics creation.

but deeper. An ST motherboard installs underneath a similarly sized board containing the 20-MHz Transputer and its 4 megabytes of dynamic RAM; the Abaq video circuitry and blitter with 1 megabyte of dual-ported video RAM; a SCSI port for the 40-megabyte hard disk drive, and the expansion slots.

The Abaq offers fast, high-resolution graphics assisted by a custom blitter chip, code-named Charity. Charity is an entirely new design; it is not the Atari device used in previous Mega STs. It is being implemented using an 8500-gate, 2-micron, CMOS (complementary metal-oxide semiconductor) uncommitted logic array. Fifty working samples of the first revision have so far been made for development work. Charity performs block moves on two-dimensional rasters of color pixels. It employs 32-bit-wide data paths and shares the bus with the Transputer CPU; it can copy rasters to and from the full address range, not just within video RAM.

The chip normally reads and writes one address location at a time and can simultaneously handle 4 or 8 pixels, depending on the video mode. The blitter allows all the normal Boolean masking operations between source and destination for overlaying and transparency effects. It also permits tests on pixel values within a given range so that the programmer can distinguish absolute colors on the screen despite the possibly discontinuous mappings of the lookup table. Charity should perform general color blits at around 10 million pixels per second.

Charity also has a special pixel block mode (PBM) that can be used only when the destination raster lies entirely in video RAM. PBM permits 32 pixels to be written in one or two cycles—a process that gives an area-fill or line-drawing capability of from 64 to 128 million pixels per second (equivalent to about 100 full screens per second). PBM also puts single-color font data onto the screen extremely rapidly, enabling quick screen updating for desktop publishing applications.

The Abaq's video system has four display modes. Mode 0 furnishes a 1280- by 960-pixel display with 4 bits per pixel; mode 1, a 1024- by 768-pixel display with 8 bits per pixel; mode 2, a 640- by 480-pixel display with 8 bits per pixel, double buffered (i.e., two separate screens for animation effects); and mode 3, 512 by 480 pixels with 32 bits per pixel.

A 24-bit hardware color lookup table maps 8-bit inputs into 24-bit outputs. Full 8-bit digital-to-analog converters (DACs) are employed to provide the analog video signals to drive the color monitor's RGB guns.

In modes 1 and 2, you can choose the 256 displayed colors from a palette of 16 million. In mode 3, the color lookup table is bypassed and 8 video bits are sent directly to each DAC, giving a fixed palette of 16 million colors—the remaining 8 bits are used as overlay and tag bits. Overlay bits are decoded in hardware and can be used to support a number of hardware-encoded cursors, while the tag bits can be used by suitably written applications programs to mark separate screen areas for efficient object-oriented graphics and sprite effects.

Atari will be offering only one high-resolution monochrome monitor with a 146-MHz vertical scan rate for mode 0 operation in 16 shades of gray—features aimed at desktop publishing and CAD/CAM users. For other modes, off-the-shelf monitors such as the NEC MultiSync Plus or XL will suffice. Still under review is the question of color operation in mode 0—but the quality of monitor required would be very expensive.

So far, Abaq's developers have designed two kinds of Abaq expansion cards. The Transputer farm board contains four T800 Transputers with 1 megabyte of dynamic RAM each, while the memory expansion board contains 20 megabytes of DRAM. A four-slot Abaq could contain 17 Transputers or 84 megabytes of RAM, or combinations in between—for example, 13 Transputers and 24 megabytes of memory (three Transputer boards plus one memory board). No industry-standard bus has been

adopted for these cards that can simply receive the Transputer memory bus signals. The Transputer links are not brought to the edge connector, but you can join them independently with point-to-point wiring to set up different configurations.

In the prototype machines I saw, the Abaq/ST interface was rudimentary, but in the finished machine, you will be able to use GEM (the Digital Research Inc. standard operating system software supplied with the Atari ST) on the Abaq screen, and access the Abaq hard disk and other SCSI peripherals from the Atari ST.

The Helios Operating System

The Abaq is a powerful enough graphics workstation, but it is the Helios operating system that will make this workstation extraordinary. The goal of Helios is to allow Abaqs to be networked together in such a way that all the processors in all the machines are potentially available to all users.

Because typical workstation users are happy with Unix, Helios is deliberately being designed to look as much like Unix as possible. The Helios shell looks exactly like the Unix C Shell and supports all the normal Unix commands. Internally, however, it works very differently from Unix in several respects: Helios has a distributed kernel versus Unix's centralized kernel; it does not need to spawn new processes in software because the hardware handles this procedure; and it names every system object, whereas Unix names only files and directories.

However, Perihelion has emulated Unix version 7 calls to the point where much of the software—especially the development tools—can be ported by little more than a recompilation. I have seen the MicroEMACS editor, running on an Abaq, ported using public domain C source code.

Thus, Perihelion is writing much of Helios in C rather than Occam; the rest is in Transputer assembly language. The in-house-produced C compiler is based on the excellent Norcroft portable compiler.

The Nucleus of Helios

Helios is a fully distributed operating system that works by message-passing. At a minimum, every Transputer in a Helios network must run a system program called the "nucleus," which consists of about 30K bytes of code. With its various workspaces, the nucleus needs about 100K bytes. The program is subdivided into four modules: the kernel, the processor manager, the loader, and the system library.

The kernel is responsible for managing all the Transputer's hardware resources; it implements the message-passing mechanism and allocates RAM to tasks from both the Transputer's on-chip RAM and the external DRAM. The kernel also provides a service called the *name server* (described in more detail later), which contains list-processing and semaphore services.

The processor manager creates new tasks, controls them while they run, and then terminates them and releases their resources. In Helios, a task is not the same as a Transputer process. It is built out of one or more concurrent Transputer processes and will contain other resources like open files, static data areas, and dynamic storage such as a stack and a heap.

Helios doesn't need to support processes as such, because on the Transputer they are provided and scheduled by the hardware. Spawning a new process requires just a couple of Transputer instructions. Thus, Helios needs no equivalent of the Unix fork procedure.

The loader is responsible for loading objects into the processor and unloading them when they are no longer needed. It translates program images and puts them into memory, loads resident modules for code sharing, and handles data objects such as fonts and other bit-mapped images.

continued

The system library is a resident code module that supports the equivalent of the system calls in an ordinary operating system. All applications programs must talk to the machine through this library. Many tasks can share resident Helios modules, resulting in great code economy. The Helios `ls` command, for example, occupies 663 bytes compared to 11K bytes under Unix.

The system library also keeps track of the resources allocated to running tasks; a table of pointers to the task's resources is the first parameter passed in any Helios system call. A second library provides Unix-compatible system calls, thus localizing and isolating any Unix compatibility problems.

Server Tasks Are Transparent

The network hardware is uncomplicated and is based on buffered Transputer serial links that operate at up to 20 megabits per second. In the worst case, you will always have at least one Transputer in your own workstation. But when other users log off, you will be able to use the Transputers in the other workstations to accelerate your own software. Or there might be a large box of Transputers on the network, such as a Meiko Computing Surface, shared by all users—just as laser printers are currently shared by network users. First there were file and print servers. Now, Helios introduces us to the notion of a "compute server."

Helios tasks may communicate only through message-passing. By contrast, the individual processes within a task can communicate by any means a programmer may wish to devise. The overall Helios design is based on a client/server model with some similarities to that of AmigaDOS—no surprise, given that both designs are descended from the Cambridge Distributed Operating System. Applications tasks request services from system server tasks by sending them messages.

In Helios, server tasks can be running anywhere on the network and are totally transparent to the user and to applications programs. This transparency is achieved by the ability of the kernel's name-server task, which can search the network to locate other servers. Like files in an ordinary operating system, servers in Helios are called objects. When you type the `ls` command, you will see servers listed as well as files.

Running `ls` again on one of these server names will list its contents. If it is a disk server, you will get a directory of files. For another kind of server, you might get a list of running tasks. If you have the necessary access permissions, you could type `ls` followed by the path name of a disk belonging to another workstation in the network and it would be duly listed. From then on, the name of that disk drive would appear in the directory list for your own workstation, because the name server now knows its location.

Helios servers are written to be "stateless"; that is, the success of a request for a service never depends on the success of a previous request. Achieving statelessness involves some repetition of information; for example, every file read or write request must supply the name of the file and its position pointer. But the trade-off is that the system is inherently fault-tolerant; any request can be repeated until it succeeds.

The Message-Passing Mechanism

Helios' message-passing mechanism must be able to pass messages between tasks on different processors, as well as between tasks on the same processor. Helios handles this operation by sending messages to message "ports." These ports are software data structures that relate to the Transputer's hardware links in much the same way that tasks relate to processes. A message port located on a remote processor is represented in the sender processor by a surrogate port to which the message is sent.

This surrogate port contains a physical link address and passes the message to a port on a next-door-neighbor processor, which may itself be a surrogate port. The message is thus passed

hand to hand until it is eventually received by a real message port. The message leaves a trail of port descriptors in each processor through which it passes, pointing back to its source. By default, the surrogate ports along the trail will be deleted to avoid wasting memory, but you can set a flag in the message header to preserve the ports and hence keep the route open for use by further messages.

If for some reason (e.g., a hardware or software failure) a message cannot be delivered to its destination, an exception is raised and returned to the sender for another try. If the exception itself fails to arrive, a timeout will occur on one of the ports. There are no routine acknowledgments of messages; they are assumed to have arrived safely if no exception is returned. Theoretically, it would be safer to have the receiver acknowledge every message, but such a process would double the time it takes to send a message. This trade-off can be justified by the high reliability of Transputer links compared to a conventional LAN.

You can build further error recovery into applications programs at a higher level. For example, the program could lock out dead links or processors (as it would bad disk sectors) and reroute messages through the good parts of the system.

While the Helios messaging system is simple and speedy, the link speed of 20 megabits per second is not fast compared to the speed with which a 10-MIPS Transputer accesses memory. Thus, message-sending is still a relatively slow operation. Tasks that need to have a predictable real-time response must either poll the reply port using a short timeout—so they are not suspended waiting for the reply—or else spawn a child process to watch the port for them.

Distributing Programs

Since there is no hardware memory protection available, Helios provides a software protection scheme based on *capabilities*. A capability is a 64-bit data structure that contains a checksum encrypted with an access mask.

This scheme operates all the way from the level of protecting data objects from the unwanted attentions of rogue tasks, to restricting human access to files. Whenever a task creates a new object, the system gives the object a unique encryption key with which it encrypts its creator's access mask and then returns the capability. A task can only access that object if it owns a valid capability containing the necessary access permission.

All client requests to servers must be accompanied by a valid capability—this process is rather like presenting a credit card. Helios allows only whole programs, rather than their component processes, to be assigned to separate processors. In this respect, Helios represents a regression from the highly parallel approach taken by Occam.

A native Occam program running on the bare hardware can have many component processes executed concurrently on different Transputers, enabling the implementation of highly parallel algorithms such as pipelines. The Helios approach, however, still allows three lesser levels of parallelism.

The first level is Unix-like; pipes connect small single-function programs such as file filters, or editors and compilers. A Helios routine called the task-force manager assigns each such program to a separate processor, if enough are available, and implements the pipes using real Transputer links. The processors can either come from the user's own cluster of private workstation processors, or be allocated from a shared pool just for the duration of the execution.

You can place frequently used programs, such as compilers, on a particular shared processor permanently and direct all invocations of the program to that processor. If a program is well behaved—if it doesn't corrupt memory belonging to other programs—this processor may be shared by several users. Other-

continued

A MESSAGE TO OUR SUBSCRIBERS

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A PERSONAL TRANSPUTER

wise, Helios never allows tasks from different users to be assigned to the same processor.

The second level of parallelism involves large programs that you can divide into modules and allocate to different processors. This division is often easy to perform, since many large programs are already written as a number of overlays. The process involves creating a blueprint file that holds a description of the application components with their memory requirements, relative placements, connections to other modules and so on. The task-force manager uses this file to place the components and execute the application.

It would be much better to have a task-force manager that could simply look at a program and decide how best to distribute it over the processors. Although this goal is the object of many current research projects, it lies well beyond the present state of the art.

The final level, with the finest granularity and highest degree of parallelism, is the Occam compatibility level. Helios can execute Occam programs by taking the components of an Occam PLACED PAR construct (a group of concurrent processes) and building a blueprint file for them, then allocating each component to a processor. Each component is made into a whole program by wrapping it in a cocoon of processes that interface to Helios system services and translating raw Occam channel communications into Helios messages.

Helios Development Tools

In addition to the C compiler already mentioned, Perihelion offers a Transputer assembler and linker and is working on a debugger that will allow one Transputer to monitor the activity of another, offering features that are normally found only in hardware debuggers. Other firms are preparing Transputer Pascal, FORTRAN, Lisp, and BCPL compilers, as well as a Helios-hosted Occam compiler.

Perihelion will supply graphics support for the programmer by porting Xwindows V11, the public domain Unix window manager that is fast becoming a standard; it has been adopted by large manufacturers such as Apollo and Hewlett-Packard. Perihelion hopes to have beta-test versions available by July. Helios will perform all graphics operations by sending messages to an Xwindows graphics server that drives the blitter. As an alternative to the C Shell, Xwindows will also be used to implement a windows/icons/mouse/pull-down-menus (WIMP) user interface.

Perihelion has written a number of disk servers. Several servers can be installed in the same system using different disk formats. Floppy servers for the IBM PC, Atari ST, and BBC Micro already exist, while the hard disk server uses a Unix 4.2 format, extended to include the Helios protection scheme.

The Future According to Transputers

The Abaq/Helios project promises to liberate the Transputer from its present confinement in the supercomputer laboratory to, at the very least, the engineering office and teaching lab. Although prices have not yet been fixed, at the time of the Abaq's announcement, Atari spokesmen said that the company hoped to keep the price below \$5000.

Clearly, the Abaq is not yet the Transputer machine for the rest of us. But such a price would be relatively inexpensive for a workstation network that should provide at least as much power as the newest offerings from Sun and Apollo. And Helios could become the basis for even less expensive machines that will finally truly bring the Transputer into the personal computer arena. ■

Dick Pountain is a BYTE contributing editor, a technical author, and a software consultant living in London, England.

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*Staff-written highlights of developments
in technology and the microcomputer industry*

Look Out, SQL: Here Come Object-Oriented Databases

Although we've been told that the database interface of the future will be based on the Structured Query Language, some experts predict that the relational database model and SQL will be severely challenged within the next 5 years by object-oriented databases. According to professor L.A. Rowe of the University of California at Berkeley, the relational database model is fine for traditional business applications but inadequate for data-

bases used for CAD, scientific, and engineering applications. Relational databases are suitable for applications requiring a small number of data types and a fairly simple set of relations. But they are not well suited for databases involving new data types, such as graphics and other complex objects, and many relations with small numbers of rows, Rowe says.

Rowe and a team of graduate students are working on a different type of database, which they call "Post-

Ingres," that lets users add new data types and customize indexing methods depending on the application. The database will also have forward- and backward-chaining rules for expert-system applications.

Post-Ingres can store "objects," such as a graphics image or a forms specification, as a record in the database, based on an "object ID number." Objects can be shared by multiple databases. The approach Rowe and his cohorts are developing will make it possible to compile frequently used queries and also store them by ID number in the database. Thus, an application program could execute "query #47," which could be a compiled binary record in the database, for example. This would greatly improve performance of complex queries.

Post-Ingres will also give users access to historical data stored on optical disks, researchers say. In fact, the system will support a three-level hierarchy of storage—hard disks, tapes, and optical disks—allowing transparent data access on all three types of media. This capability would be extremely useful for accessing historical data, such as archived medical or legal records.

"Next-generation" database systems will appear within 3 to 5 years and will be developed using object-oriented programming and window interfaces on graphics workstations, Rowe predicts. Alphanumeric terminals eventually will be replaced by graphics workstations for most database applications, he added.

continued

Nanobytes

- Despite being recognized as technologically impressive personal computers, **Atari's ST and Commodore's Amiga** haven't had the kind of market success enjoyed by machines from IBM et al. and Apple. So what's the problem? Part of the problem is that "computers are not powerful enough to be used at home for anything productive," says Neil Harris, director of product marketing at Atari. "I think the ST and the Amiga are in the right direction, but we're still not there yet." Harris also blames the industry press for not covering the Atari machines enough. "The computer press is too busy analyzing its readership," he says. He also cites less malevolent forces, such as the RAM shortage. As for Atari's success in Europe, as opposed to the U.S.: "MS-DOS wasn't entrenched overseas, and there's much less disposable income there, so when a lower-cost alternative was introduced, it was embraced" by the Europeans.

- Researchers at the **National Bureau of Standards (NBS)** are working on tools for measuring the performance and efficiency of multiprocessors. The tools differ from software measurement systems in that they don't affect the program that's being measured. The researchers at the NBS Institute for

continued

Flat-Panel VGA Displays Due Next Year in Portables

By 1989 we'll be seeing portable computers sporting flat-panel VGA displays. One major manufacturer of thin-film electroluminescent displays, Planar Systems (Beaverton, OR), now sells a 640- by 400-pixel electroluminescent screen and plans to introduce a 640- by 480-pixel by 16-gray-scale VGA display in 1989.

Planar's Rolland Von Stroh said the company is working with both domestic and Far East computer manufacturers on a number of new projects involving flat-panel displays. Such screens are not limited to portable applications; some manufacturers plan to use 19-inch flat-panel displays in their engineering workstations.

The next major development in the flat-panel field will be color displays, said Von Stroh. Planar will introduce full-color flat-panel displays in military applications, such as airplane

cockpits, in early 1990, and the first industrial applications of full-color flat-panel displays will follow later that year, he said.

Von Stroh predicted that flat-panel displays will eventually capture a large share of the CRT market. By 1995 they could have 50 percent of the current CRT market, he said. Flat-panel displays have some advantages over CRTs. They are, of course, much more compact, have much less glare because of their flat surface, consume much less power (14 watts versus 50 to 100 watts), and are more reliable (according to Von Stroh, 45,000 hours mean time between failure versus 10,000 hours for CRTs). They cost 3 to 5 times as much to make as CRTs. However, Von Stroh claimed that thin-film electroluminescent displays are already displacing backlit LCDs and gas-plasma displays because of things like better contrast and greater range of viewing angle.

drive, but it will work on one floppy disk drive.

Price: \$29.95.

Contact: Elliam Associates, P.O. Box 6922, Los Osos, CA 93412, (805) 528-5871. **Inquiry** 835.

PageMaker 3.0 for the PC

PageMaker 3.0 includes support for long documents, image controls for scanned and bit-map images, and import filters for Lotus 1-2-3, Symphony, and dBASE. With the new filters, you can put worksheet and database files directly into PageMaker documents without intermediate file conversion. You can also import files from Freelance and

Harvard Graphics.

It includes 20 templates for reports, newsletters, slides, flyers, proposals, and other documents. You can modify the templates to suit your needs or create your own.

New capabilities include automatic word wrap around rectangular graphics and customized wraps for irregular shapes. You can make spot-color overlays for commercial printing and color documents with selected color printers. Image controls for scanned and bit-map images work with PostScript and non-PostScript language printers.

PageMaker 3.0 works with IBM ATs, PS/2s, or other Windows-compatible computers. It requires 640K bytes of RAM, a 20-megabyte hard disk drive, an EGA, VGA, or Hercules graphics card, DOS

3.0 or higher, Microsoft Windows 2.03, and a mouse.

Price: \$795.

Contact: Aldus Corp., 411 First Ave. S, Suite 200, Seattle, WA 98104, (206) 622-5500. **Inquiry** 832.

Making Music on the Atari

Midisoft Studio Advanced Edition includes the same features of the original version plus added editing, programming, and other capabilities. The previous version's features included 32 polyphonic, independently controlled tracks; real-time tempo changes and track mixes; and full-track editing and flexible region editing.

The music program lets you record in real time, play back, overdub, and rewind on 64 polyphonic, independently controlled tracks. On an Atari 520ST, the limit is 30,000 notes per song; on a 1040ST, the limit is 70,000.

The advanced edition offers MIDI event editing, which gives you control over entering, changing, and removing all aspects of the music. It lets you program tempo changes, supports up to 16 MIDI channels per track, offers real-time MIDI volume control and real-time octave transpose for each track, and displays MIDI-through controls on the main screen.

Price: \$149.

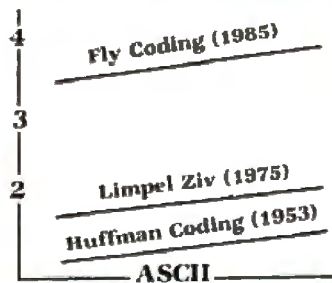
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CHAOS MANOR MAIL

*Jerry Pournelle answers questions about his column
and related computer topics*

The European Market

Dear Jerry,

In your February column ("Life after Las Vegas," page 182), you seemed surprised that in Europe the Atari ST has gained a "serious machine" status, which perhaps it lacks in the U.S. In fact, most Americans don't realize that the computer market here in Europe is quite different from what they're used to. Prices here tend to be much higher for most brand-name machines, and some interesting products are hard to find.

To give you an example, I recently bought an Atari Mega ST2. Its list price, including a 20-megabyte Atari hard disk drive, was about \$2700 here in Italy. Such a price might sound expensive in the U.S., but, for reasons beyond my comprehension, Apple is selling a comparably equipped Macintosh SE (with 1 megabyte of RAM and a 20-megabyte hard disk drive) for \$5700. And dealer margin is low enough that you can't get a discount of more than 10 percent (which is comparable to what you can get on the Atari). As you can see, over here the Atari—even the Mega series—still gives you the most computer for your buck, at least in the 68000 world. In fact, I can buy an Atari Mega ST2 with a hard disk drive and the Atari laser printer for less than I'd have to pay for the Apple laser printer alone.

Given this, if you decide to get off the MS-DOS or OS/2 bandwagon and you don't have a little fortune to spend on the Mac, the Atari seems a good choice. As a result, many small businesses, professionals, consultants, and independent offices are turning to the Atari as a system that is inexpensive and easy to use. The Atari also lets them do their tasks (e.g., word processing, desktop publishing, and communications) at a reasonable price.

Why Apple is pursuing such a policy is a mystery to me, but I think Atari's big success is partly due to Apple's absurd pricing policy. If Macs were sold for what they do in the U.S., the market might be different. But in the current situation, the Atari is very strong, especially in En-

gland and in West Germany, where there's an impressive range of locally written software for the Atari computers.

As for the 80x86 world, the business here is lagging behind the U.S. developments; people are still buying 8088 machines as their first machines, not realizing that those are already obsolete. People are also very confused about the whole OS/2 story—whether it is real, whether it will be real some day, and so on. In fact, with so many hardware and software standards, doing system integration in the PC-compatible game is something short of a nightmare—more so here, because many things that would make your life easier just aren't available here. Often, if you decide to go with MS-DOS, you're stuck between either true-blue IBM (it costs a little less than \$10,000 for a PS/2 Model 60 with a dot-matrix printer) or Taiwanese equipment, which is often sold by dealers with very little competence. Clone machines are usually a good deal, but you'd better know what you're doing, because no dealer will be out there to help you.

Macs are easily available (not so for the software, though, and I know of some official Apple dealers who make good money on pirated software), but at their high prices they have found their natural niche in the academic market.

As you see, the market situation here is quite different, and that explains why some machines—such as the Commodore 64—have been big hits in Europe. On the other hand, the American market tends to be provincial; both users and companies think nothing exists beyond the U.S. Good products (especially software) get developed in Europe, too.

Fabio Favata
Palermo, Italy

continued

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerryip."

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Thank you for the report. One reason Atari and Amiga sell in Europe is because they don't have to pay so much attention to certifications by the FCC. I do wonder if the FCC's real purpose here is to help the administration deal with the "too strong" dollar. If so, I have news; they've been wildly successful. —Jerry

The Trouble with MIS Professionals

Dear Jerry,
I'm writing about the letter Charles Hahn wrote you attempting to defend the behavior of corporate data-processing departments ("In Defense of DP Departments," March, page 36). When I first read the letter, I dismissed it as just another point of view that raised some interesting points even if I didn't fully agree with it. However, after more thought, it strikes me that Mr. Hahn's letter is a classic case of what's wrong with many MIS (and managerial) professionals. I also can't help but think that there's another side to his story, and I'd like to hear it.

On one hand, Mr. Hahn is upset about the lack of initiative shown by the people in his company, since they don't like to work voluntary, unpaid overtime and

won't learn how to use their machines on their own time. (I suspect what he means is that people won't take the often boring manuals home to study them to a point just short of memorization. Has he ever tried letting people take both machines and manuals home to experiment with? I've found that technique works.) On the other hand, Hahn is angry that his ex-director, who actually showed some initiative, used his own programs and hardware instead of Lotus and WordStar, which are apparently the only two MIS-approved programs.

I can't help but wonder what the situation would have been if Mr. Hahn's company had a policy of listening to its employees and had actually bought the director an IBM PC AT and first-rate software to go with it in the first place. I also wonder what it was that caused the director to leave the company. Corporate attitudes, perhaps?

Frankly, I think the fundamental problem is that many managers forget that no matter what sort of equipment and hardware they may buy to improve productivity, the people who run the machines still determine the ultimate suc-

cess and/or failure of the operation. While it may be unfortunate for business, the fact is that the people running the machinery aren't machines themselves.

George P. Nelson
Springfield, VA

Well, I had much the same thought myself; the purpose of small computers is to enhance productivity, and I doubt very seriously if even the cleverest MIS director has thought of all the ideas. Giving intelligent people good tools and watching to see what they will develop with them has always seemed to me a much better idea. —Jerry

Users versus Businesspeople

Dear Jerry,

I'm writing in response to Richard H. Goodyear's letter ("No Mac Clones," August 1987). He says that while users have written a lot about the Macintosh, businesspeople have spoken "eloquently by their silence," as there are no Macintosh clones.

It was, as you remarked, an "interest-
continued

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WHAT'S NEW

H A R D W A R E • S Y S T E M S

U.S. Newcomer Introduces First PS/2 Portable

The Darius ProPortable from Mission Cyrus is the first PS/2-compatible "portable," the company says.

But since it weighs in at a hefty 20 pounds, it's better characterized as in the "transportable" category. Mission Cyrus says the product will be 100 percent compatible with the IBM PS/2 Models 70 and 80. It also includes two Micro Channel slots.

Based on an 80386 processor running at 25 MHz, the ProPortable uses a static RAM cache and has sockets for both 80387 and Weitek math coprocessors. One megabyte of RAM is standard, expandable to 16 megabytes on the motherboard.

Both SCSI and modified frequency modulation hard disk drive controllers are also included, as is a 10-Mbps Ethernet controller. There's even a built-in ink-jet printer that a company spokesperson says is based on Hewlett-Packard's "drop on demand" technology.

The VGA monitor displays a 16-level gray scale, or you can use a standard hookup for an external VGA monitor. Options include 40-, 100-, and 200-megabyte hard disk drives and a 2400-bps internal modem. A built-in tape backup drive is also an option. Mission Cyrus promises fax and cellular options soon. **Price:** About \$10,000.

Contact: Mission Cyrus Group, 1505 South 192nd St., Seattle, WA 98148, (604) 432-7727.

Inquiry 1129.



Mission Cyrus's portable PS/2 clone.

One-Pound MS-DOS Laptop Makes Debut

The personal computer has reached a new level of miniaturization, according to Atari. The company now has a QWERTY-keyboard-based, 1-pound, MS-DOS personal computer.

The Portfolio has most of the standard features you've come to expect in a laptop. For transferring files to your full-size system, you can use an optional expansion chassis with serial and parallel ports.

The 4.92-MHz 80C88 microprocessor supports 128K bytes (expandable to 640K bytes) of system memory. For the BIOS and a half-dozen applications, each Portfolio has at least 256K bytes of ROM in a cartridge that's connected to the bottom of the

computer through a 64-pin connector.

The keyboard, with tiny calculator-size keys, fits easily into the 8- by 4- by 1-inch chassis, as does the monitor with its resolution of 240 by 64 pixels. The LCD display produces an 8-row by 40-column platform, except in Lotus 1-2-3 mode, when figures are displayed in a 255-row by 127-column platform.

Battery power comes from three AA batteries and is rated at 48 hours of continuous use or four to six weeks of casual use. Bundled applications that run off MS-DOS 2.11 include a basic word processor, a spreadsheet that's Lotus 1-2-3 compatible, an address book, a calendar, and a calculator.

Price: \$399.

Contact: Atari Computer, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088, (408) 745-2000.

Inquiry 1127.

SEND US YOUR NEW PRODUCT RELEASE

We'd like to consider your product for publication. Send us full information, including its price, ship date, and an address and telephone number where readers can get further information. Send to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Information contained in these items is based on manufacturers' written statements and/or telephone interviews with BYTE reporters. BYTE has not formally reviewed each product mentioned. These items, along with additional new product announcements, are posted regularly on BIX in the microbytes.sw and microbytes.hw conferences.

Kiss a Portable 80386

There's a new display option in the fast-changing world of portable computers: Kiss Computer has incorporated a flat-panel, DC electroluminescent (EL) screen into a new 20-pound 80386 "tower" portable called the PX386.

The tilting amber screen, which measures only 4 inches high, 9 inches wide, and three-fifths of an inch deep, uses the same amount of power as a backlit LCD, yet it is faster, more rugged, and longer lived, Kiss claims.

The PX386 is available in several configurations. The motherboard supports a 16-, 20-, or 25-MHz CPU, with or without a math coprocessor, and it can include up to 8 megabytes of RAM (2 megabytes is standard).

Mass storage options include hard disk drives ranging from 20 to 383 megabytes and half-height 5¼- or 3½-inch floppy disk drives.

Kiss says the DC EL screen, made by Cherry Electric, is an improvement over older AC EL screens, which were fragile and suffered from flicker and an audible buzz. The new screen offers advantages over LCD as well, Kiss says. It can be read easily from the side and is very fast, with no visible ghosting.

The display has 640- by 200-pixel resolution using the CGA standard. Support for Hercules and VGA is planned for late summer.

Price: Base system, \$3995.

Contact: Kiss Computer Corp., 2604 Washington Rd., Kenosha, WI 53140, (800) 438-5477 or (414) 652-5477. **Inquiry 1128.**

continued

SHORT TAKES

BYTE editors' hands-on views of new products

Portfolio

Altima One

Finesse

MacroMind Director

MultiPlus



A Good Thing in a Small Package?

The trouble with computers is that they're too expensive, too big, too heavy, and too inconvenient. Atari thinks it has an answer to all those problems in a portable computer that's handy, light, small, and inexpensive. The big question, of course, is whether Atari can deliver the full power of an IBM PC clone in a computer that will fit in your pocket.

The good news is that the size problem is licked. The Atari Portfolio is a hand-held clone that folds to about the size of a VCR tape—8 by 4 by 1 1/4 inches. It fits easily into my inside suit-coat pocket, although I wouldn't necessarily want to carry it there all day—the Portfolio weighs about a pound with its batteries (three AA cells).

So far, so good. But does it make the grade as a PC clone?

The Portfolio uses Intel's CMOS version of its venerable 8088—the CPU that was in the original IBM PC. At 4.92 MHz, it's slightly faster than a standard PC or XT but far slower than most clones. It also has less RAM and a slower CPU than most clones

offer today (the Portfolio does have a provision for up to 640K bytes of RAM).

The keyboard is the first and most obvious place where the Portfolio's downsizing presents a problem. It's usable for two-finger typists—quite usable, in fact. The keys are plastic, not the rubberized "chiclet" keys that some calculators use. But you won't have much luck touch-typing on this scaled-down keyboard, at least not without lots of practice. I found it adequate for taking notes, but I wouldn't want to use it for more than a few hundred words of typing.

The screen, like the keyboard, is designed on a small scale. However, it's easily readable. The Portfolio emu-

lates a monochrome display adapter, and although the display contains 240 by 64 pixels, the system can't really make use of graphics (at least not without special driver software). As with the keyboard, I found the screen to be quite reasonable for small, quick jobs—such as note taking and quick calculations—but I'd hate to take on a major task with it.

There will eventually be two ways of transferring software and files into the Portfolio. One way is through the serial port, using LapLink-style software. But right now, the Portfolio doesn't have a serial port. Atari says that a "smart cable" that attaches to the Portfolio's expansion port

and comes out as a standard serial port will be available shortly for under \$50.

The other way of transferring files from a desktop PC is by copying them onto a Portfolio memory card—a solid-state, removable RAM disk that's about the size of a credit card. It's the Portfolio's answer to disk drives. The memory cards slide into the left side of the machine and offer up to 128K bytes of RAM or 4 megabytes of ROM.

I saw a beta version of a new application designed for the Portfolio, but I didn't see any regular PC programs running on the machine. And I didn't see the soon-to-be-released memory-card drive that will fit into a standard PC slot, for transferring files back and forth between a desktop PC and the Portfolio.

The final element of the system is a memory-expansion pack that will let you boost the Portfolio's RAM from 128K bytes to a full 640K bytes. Like the smart cables, it will plug into the Portfolio's expansion port and will be essential for using the Portfolio with standard PC software. Also like the smart cables, the memory expansion wasn't yet available when I looked at the Portfolio.

I liked the Portfolio—I really did. But the questions I still have about software compatibility are serious.

The entire operating system is in ROM, and that may affect the operation of some programs. I'd like to know whether standard programs like Lotus 1-2-3, WordPerfect, dBASE III Plus, and SideKick will work in the Portfolio. Atari claims that the built-in spreadsheet uses Lotus-compatible files. I'd like to see that for myself.

I'd also like to see what

continued

THE FACTS

Portfolio
\$399

Standard configuration:
It runs at 4.92 MHz and has 128K bytes of RAM, a 40-column by 8-row display, and a 63-key miniature keyboard.

Atari
1196 Borregas Ave.
P.O. Box 3427
Sunnyvale, CA 94088
(408) 745-2000.
Inquiry 1034.

effect the 40-column by 8-row screen has on conventional software, and how usable the keyboard is with software that's not specifically designed for the Portfolio. I'd like to see how it performs under the BYTE benchmarks.

Disk access should be very fast with the memory cards, while number crunching may be miserably slow.

I enjoyed using the Portfolio. It's wonderfully lightweight and splendidly convenient. When I used it, I thought

for the first time that I was using a truly portable computer—a truly personal computer. But for all its appeal, it's not finished yet. Right now, at \$399, the Portfolio isn't a toy, but it's an expensive executive notepad and

pocket calculator. Once it's complete, with the smart cables and memory expansion available, it could be the first PC clone that will fit in your pocket without emptying your wallet. □

—Frank Hayes

A Good Luggable



If you're the kind of person who lugs your machine from home to office and back, you'll probably like the **Altima One**.

The Altima One 80286 system has plenty of features and weighs in at a totable 15 pounds. It includes a built-in 2400-bps modem; a 20-megabyte hard disk drive (soon to be 40 megabytes); a tolerable, detachable 101-key keyboard; a decent supertwist, backlit LCD; a CGA screen; a mouse (and a place to store it); and a good bit more.

Things I like about this machine include the fact that it

has an automatic setup program, runs through a visible set of diagnostics on boot-up, acts more like a desktop than a portable, and lets you choose between black text on a white background or the reverse. I also appreciate that just about everything the company says will work does.

DOS 4.0 and SideKick Plus come with the Altima One, along with a mouse. I looked at a preshipping version, and the mouse wasn't included. The system also comes with 1 megabyte of RAM (expandable via the addition of single in-line memory modules to 5

THE FACTS

Altima One
\$2699

Standard configuration:
It comes with 1 megabyte of RAM; a 20-megabyte hard disk drive; a 1.4-megabyte 3½-inch floppy disk drive; a supertwist, backlit LCD screen; an internal modem; and a 101-key keyboard.

Software:
DOS 4.0 and SideKick Plus.

Altima Systems, Inc.
1390 Willow Pass Rd.,
Suite 1050
Concord, CA 94520
(415) 356-5600
Inquiry 1035.

megabytes), 640K bytes of regular memory, serial and parallel ports, and an expansion slot for half-size 8-bit cards. It also has some built-in security functionality with a password request upon boot-up and runs with an average wait state of 0.7.

I ran the BYTE benchmarks on the system, and it ran as well as I guessed. Its CPU index is 2.02, a bit faster than the Zenith SupersPort 286, which comes in at 1.55. And the disk index is 1.34, compared to the SupersPort's 1.06.

Some things I didn't appreciate are the tinny-sounding and-feeling keyboard, the fact that the handle gets in the way while you're working, and the larger-than-life on-screen characters in color mode.

Some kibitzers commented on the forbidding, robotic look of the machine itself, and they wondered out loud what this machine has that others similar to it don't. My answer is that it's a full-featured and affordable machine that, without its external battery pack, you can tote around and not get a hernia.

A few caveats. If your software doesn't work in monochrome mode, try it in color mode. If you have a hard time getting used to the configuration of a non-IBM keyboard, you can attach an IBM PC-compatible keyboard.

Other than a few minor nit-picks, the machine seems to do what it was designed to do—amazing in itself. □

—Janet Barron

Logitech Brings Finesse to Low-Cost Desktop Publishing

Low-cost desktop publishing packages haven't exactly threatened the more expensive and capable programs like PageMaker and Ventura Publisher, and they probably never will. But Logitech's **Finesse** brings respectability

and panache to the neighborhood of low-end page-make-up software.

If you're just getting started at using a PC to lay out documents and pump text into

them, **Finesse** is an excellent package. It runs on a pretty basic system, with its most exotic requirements being 640K bytes of RAM, a hard disk drive, and a CGA board. I worked with a beta copy of the

program on a Compaq 286 with a VGA display. It looked sharp and ran flawlessly.

Finesse is a GEM application, so you work in the nice Digital Research environment

continued

Coping with Diversity

IBM PC, Macintosh, Atari ST, Amiga, or Apple IIGS— incompatibility need not restrict your choice of a second computer

Bob Ryan

The computer industry pays a lot of attention to compatibility—perhaps too much. The fact is, no one computer architecture or operating system can be all things to all users. This becomes evident when you consider purchasing a computer for a specific task, such as creating presentations for your business or providing a home computer for your family. Ideally, you'd like to have a computer that is compatible with the DOS machines you use at work, but you'd also like to address specialized areas that are not best served by a DOS machine (e.g., desktop video, education, or music). What do you do?

Most likely, you'll make a choice between compatibility with your office computer and applicability to your other pursuits. You won't have to make such a choice, however, if you replace the requirement for compatibility with one that emphasizes *interoperability*.

Tripping the Tongue Fantastic

Interoperability describes the exchange of data between computers that have different architectures or are running under different operating systems. In practice,

it means being able to transfer files between different types of machines, and being able to *use* the files on both. Thus, if you could transfer files between your office computer and your home computer, you might not be restricted to a home machine that is compatible with your computer at work.

There are different levels of interoperability—from simple text transfers to

hardware emulations—that let you work with the same data on different computers. The solutions discussed here apply to any situation that demands interoperability, from sharing data between adjacent computers in the office to taking data from work to be massaged by a home computer.

Exchange Limits

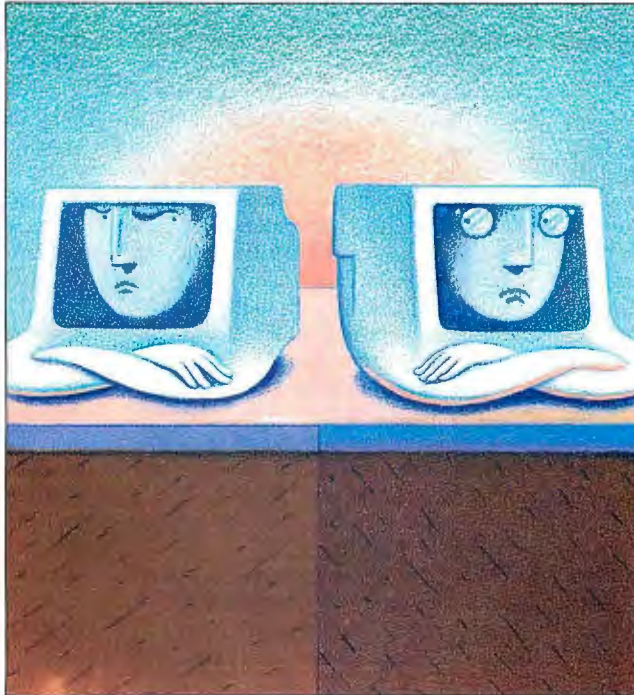
While you can transfer just about any file between any two computers, the types of files you can *usefully* exchange is more limited. Of course, transferring executable files from one architecture to another is fruitless unless you have some form of emulation that lets the second computer use software written for the first. Emulations do exist (see the text box "Out of One, Many" on page 258).

But, for the most part, the objective is to transfer data files from one machine to another in a format that both the operating system and an application program running on the target machine can use.

Making a Connection

The most common mode of data exchange between dissimilar computers is

continued



Out of One, Many

So you really need strong compatibility between your office machine and your home computer, but still want the advantages of an Atari ST or an Apple IIGS at home. Don't despair; you have options that don't involve buying another computer system.

Emulators are software or hardware products that let you run software written for one computer on a completely different computer. Emulators have been around for at least a decade, although their history is a bit checkered.

For example, in the early 1980s, Rana Systems brought out a hardware emulator that let you run DOS software on an Apple II. The problem was that the emulator cost nearly as much as a stand-alone IBM system. Rana Systems, which had had a bit of success selling replacements for Apple II disk drives, did not survive its foray into hardware emulation. Other examples of failed hardware emulators, from the Dimension 68000 to MacCharlie, litter the byways of the personal computer world.

The Beat Goes On

Because it is such a compelling idea, emulation didn't die along with these early implementations. Today, you can buy hardware and software emulators that let you run DOS, Macintosh, even Commodore 64 software on different hardware platforms. I will concentrate on some of the hardware emulators because, although they are more expensive than software emulators, they invariably perform better and provide better compatibility.

Today, you can successfully run DOS software on an Apple II, Macintosh, Atari ST, or Amiga, and Mac software on an Amiga or Atari ST. Often, it's not the software that proves incompatible, but the hardware. For instance, you may not be able to access all the I/O

ports (e.g., mouse, disk drive, parallel, and serial) on your machine from the emulator. Check the specifics of each emulator before you buy one.

PC on a Card

Because DOS has the largest installed base of any microcomputer operating system, it's a natural target for hardware emulation. If you own a Mac II, you can emulate a PC AT with the Mac286 from Orange Micro. If you own an Apple IIGS, you can emulate a PC XT by installing the PC Transporter from Applied Engineering. Both of these emulators are "computers on a card" that plug into expansion slots on their respective machines and let you run a wide variety of DOS software, often at speeds exceeding that of the emulated machine. PC Speed from Michtron provides DOS compatibility for the Atari ST.

Commodore has gone one step further in its emulations of AT (the A2086 board) and XT (the A2088) computers. Commodore's Amiga 2000 contains a four-slot AT bus on its motherboard, in addition to its Amiga Zorro slots. The emulator boards sit in both an AT slot and a Zorro slot. You can use the extra AT slots for IBM peripheral cards, thus providing expansion compatibility as well as software compatibility.

The Amiga 2000 with an IBM emulator has another interesting feature. Because the Amiga operating system is multitasking and the IBM emulator runs from an Amiga task (see figure A), you can run AmigaDOS and DOS programs concurrently and even cut and paste between the two.

All in the Family

While these DOS emulations, in effect, put a computer, complete with microprocessor, on a card (or two), many em-

ulations need not be so extensive. Two examples are Spectre GCR, from Gadgets by Small, for the Atari ST, and ReadySoft's A-Max for the Amiga. Both of these products let you run Macintosh software on these machines. The emulators themselves are not as extensive as the DOS ones because the Amiga and the Atari ST use the same microprocessor as the low-end Macintoshes—the MC68000. Therefore, they can use their own processors to execute the Macintosh instructions.

What both of these emulators lack are the Macintosh ROMs. If you buy A-Max or Spectre GCR, you will have to buy Macintosh ROMs and plug them into the emulator. The fact that Apple's legal department has not taken action against the emulators seems to indicate that the emulators don't step on anyone's copyrights or patents. Atari, in fact, indicated at Fall Comdex 1989 that it considers the combination of its portable ST, the Stacy, and Spectre GCR to be a viable alternative to the Mac Portable.

One-Way Street

Most emulators enable those machines with a smaller installed base to run software written for DOS and Macintosh computers. Thus, you have the Amiga emulating the AT or the Mac, but not the reverse. By virtue of their larger installed bases, DOS machines and Macs have many more software packages available than the Amiga does. Since one of the prime reasons for an emulator is to tap into a larger base of software, there is little motivation for an AT to emulate an Amiga.

Amiga, Apple II, and Atari machines each have areas in which they excel. Emulation can give you the best of both worlds: compatibility with your primary computer and the advantages of an alternative architecture.

a serial connection; it can be either direct or remote. The advantage of a serial connection is that you don't have to worry about disk formats. A Mac file sent via a serial connection to a DOS machine is saved on the target machine in DOS format.

With a direct connection, you hook up the two computers with a null-modem cable, load communications software on each, and transfer files at will. The advantage of this method over indirect

methods is that you can transfer data at much higher baud rates than you can using a modem. The disadvantage is that the computers have to be at the same location. Thus, direct connections are best for transfer between two office computers. They will not help you with home-office transfers.

Many companies offer products that provide both the software and hardware

for direct file transfers. Traveling Software, for example, sells LapLink-Mac for high-speed file transfers between DOS machines and Macintoshes.

Indirect methods involve using a modem. Although transfer rates are slower using a modem, the computers involved can be miles apart.

You have two choices in modem transfers. You can have one computer call the other directly, or you can use an inter-

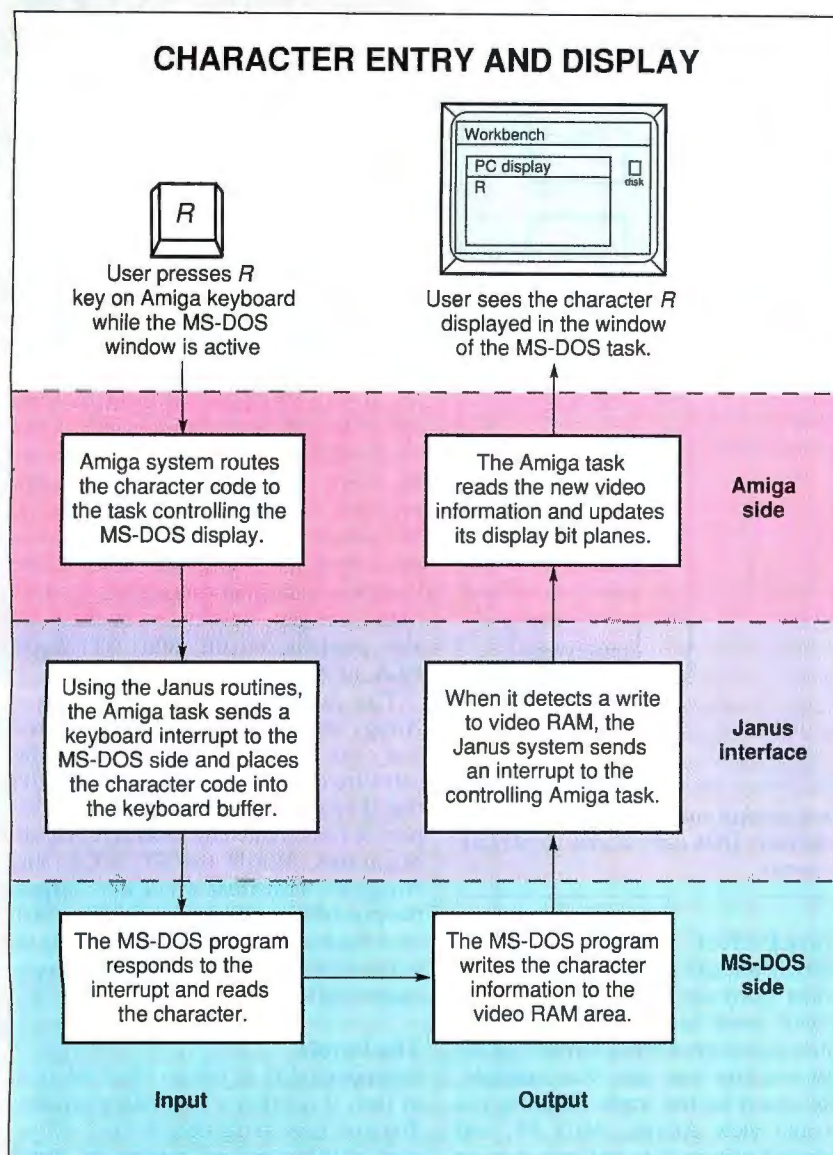


Figure A: The Janus interface between the DOS board on an Amiga 2000 and the controlling Amiga task sends keyboard input to the DOS side and makes the DOS video RAM accessible to the Amiga output system.

mediary, such as BIX or CompuServe. The first option works only if you have communications software for one computer that allows it to operate unattended. The second option is much more common for home-office transfers. While you're at work, you access your account on the information service and upload the data. Then, when you get home, you download the data using your home computer.

The Data Disk Exchange

Another common method of data exchange involves direct disk access. Although it's not possible under normal circumstances for one operating system to read and write to data disks formatted by another, specialized software and hardware are often available to provide this capability. Because DOS is the most popular microcomputer operating system, most of these specialized products are

designed to allow non-DOS computers to read DOS disks.

For example, a utility for the Amiga called CrossDOS, from Consultron, lets you access DOS, as well as Atari ST, disks from the Amiga. It works with the standard Amiga 3½-inch drives.

The Apple SuperDrive, standard on upper-end Macintosh computers (and available as an external option for other Macintoshes) lets you transparently access Macintosh disks with the Apple IIGS and vice versa. More important, however, by using a special utility from Apple, you can access DOS-formatted disks placed in the SuperDrive.

The Atari ST provides the simplest method of direct file exchange with DOS. Since the ST disk format is nearly identical to the DOS format, you can read and write to DOS disks with an Atari ST disk drive. Conversely, you can read and write to Atari ST disks with a DOS computer.

Of course, any disk you plan to use on two different machines must be in a format that the drives on both machines can handle. There are restrictions on the formats that some systems can handle. For example, CrossDOS for the Amiga can read 720K-byte DOS disks but not 1.44-megabyte disks. The standard Amiga disk drives are unable to handle the higher density.

In this age of heterogeneous LANs, you may also have access to another transfer technique. For example, many LANs provide a gateway to AppleTalk. With such a system, you can easily transfer a file from a DOS machine on the LAN to a Macintosh or IIGS located on the AppleTalk network. NetWare for Macintosh from Novell is an example of such a gateway (see figure 1).

Format Blues

It's not difficult, then, to move a file between computers that are based on dissimilar architectures. File transfer, however, is only half of the interoperability picture. You have to be able to use the files after you transfer them. Having a file in the proper disk format doesn't ensure that it's in the proper file format for your application.

The simplest file format, and the one that is most commonly used in transfers between different computers, is ASCII (or text) format. Most word processors and many other types of application programs can read and write to ASCII files. The only problem that you are likely to encounter is with the end-of-line character.

continued

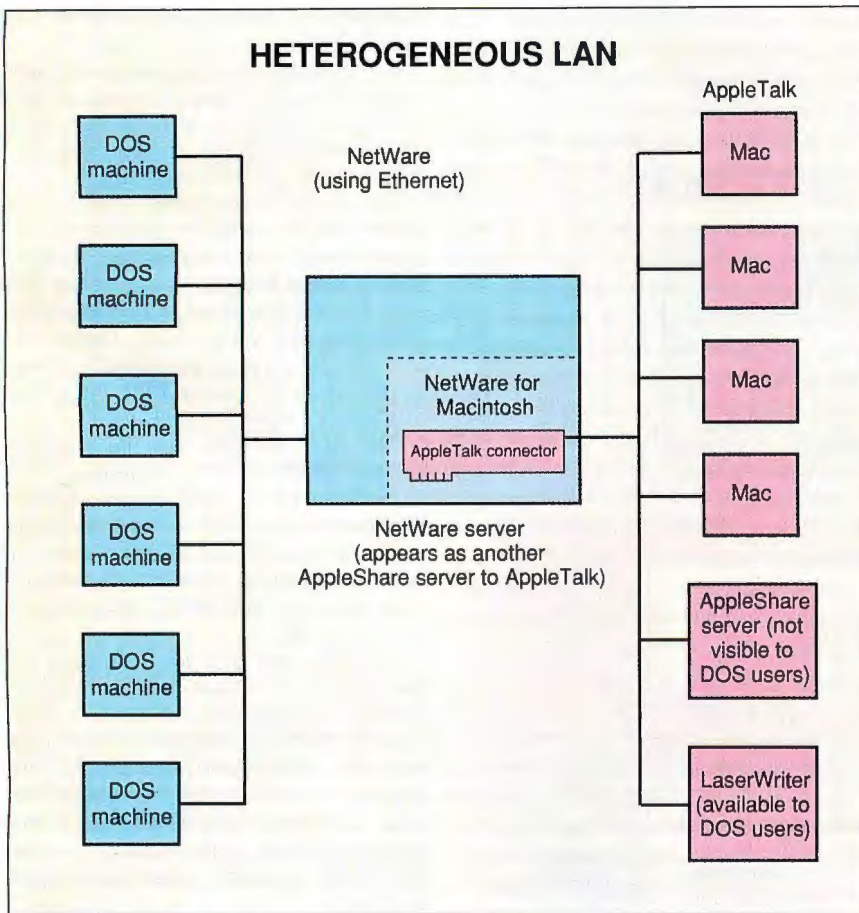


Figure 1: NetWare for Macintosh is a NetWare process that communicates with AppleTalk via an AppleTalk connector. The gateway lets DOS users access AppleTalk printers and AppleTalk users access the NetWare server.

Different applications and operating systems use different end-of-line characters. Some use carriage returns, others use linefeeds, and still others use a combination of the two. The problem is that if you load an ASCII file with one type of end-of-line indicator into a word processor that uses another, you can get unexpected results.

Thus, you may want a utility to strip or add carriage returns or linefeeds. Fixup is a public domain utility for the Macintosh that can strip linefeeds and carriage returns from a file, or convert one to the other. Another Mac utility, a shareware program called Macify, lets you perform all sorts of transformations and conversions on text files. Other systems have similar utilities available (e.g., Strips for the Atari ST and CR for DOS).

Converting text files is important for many applications, especially word processing, but text file transfers have limited utility. For one thing, the files lose most of their original formatting in the transfer.

Picture Perfect

Although you can easily transfer graphics data from one machine to another, you will need specialized conversion utilities to convert it into a format that the target machine can use. For example, SHRConvert for the Apple IIGS lets you load and view Amiga, Atari ST, and Macintosh picture files and save them in IIGS-compatible format. Picswitch for the Atari ST does the same thing with Macintosh and Amiga files, while Mac-view (for Macintosh pictures) and Am-GIF (for GIF files) provide this function on the Amiga.

These file converters and others are available as public domain and shareware programs. More powerful conversion utilities are available from commercial software sources. For example, Mac-LinkPlus/Translators from DataViz performs 76 specific DOS-to-Mac and 76 Mac-to-DOS conversions. As computers become more graphics oriented, the need for graphics-conversion utilities will increase.

Miraculous Conversions

Although the explicit conversion of files from one format to another is often necessary, it isn't the most convenient route to take. The best route is implicit conversion, where the application does the conversion for you. In other words, the applications you use load and convert file formats automatically.

Many word processors and spreadsheets let you load and save files created by other programs. Many spreadsheets and database programs also support the DIF format, a specialized text file format that is useful for transferring text data in a row-and-column format. DIF files, however, cannot contain formatting information.

Of course, the situation is even easier if you're using the same program on two different computers. However, it's not always easy to find a product that runs on the particular computers you have. For example, only one major application, WordPerfect, runs on all five of the computer systems highlighted here. While there are many applications that span the Mac/DOS gap, only a few of these are also available on the Atari ST, Apple IIGS, or Amiga.

The fact that most ST, IIGS, and Amiga developers are smaller and have less clout than the major DOS and Mac software companies makes it imperative that they provide for the import and export of files created by DOS and Mac applications. While the ST, IIGS, and Amiga all have areas where they surpass the capabilities of the more popular business machines, the onus of providing interoperability with major business applications falls on them.

The Payoff

Interoperability is not an ideal solution; in fact, it is often a frustrating process. You may have to dig deep to find conversion utilities or applications to match your needs. In some cases, the necessary utilities and applications may not yet exist.

So why bother? Because, in the long run, interoperability greatly expands your computing options. Imagine being able to take advantage of the MIDI capabilities of the Atari ST, the video and animation power of the Amiga, or the educational software available for the Apple IIGS—without sacrificing the ability to bring work home. Incompatibility does not have to be an obstacle; it can be an opportunity. ■

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."

Display's Industrial-Strength Color Monitor

Display Technologies' new 7½- and 9-inch VGA-compatible Color Pix.L monitors can withstand temperatures of up to 140 °F, shocks of up to 30 g's, and vibrations of up to 2.5 g's on all axes. Both monitors use Trinitron CRTs, which provide the sharp images and bright colors necessary for use in test instrumentation, medical, and process control applications, the company reports.

Price: 7½-inch monitor, \$1050; 9-inch monitor, \$1169.

Contact: Display Technologies, Inc., 1355 Holmes Rd., Elgin, IL 60123, (708) 931-2100.

Inquiry 1015.

Test ROM Images Without Burning EPROMs

ROM-IT, a ROM emulation system that lets you test ROM images without having to burn EPROMs, lets you emulate up to eight 1-Mb EPROMs from one host serial port through the addition of ROM-IT cards. The ROM-IT system itself measures 5 by 5 by 1½ inches and connects to any serial port capable of 9600-bps operation. The card supports host serial interfaces that transmit at up to 38,400 bps. You can also connect the stand-alone system through the computer's parallel port.

Incredible Technologies says that the system can download 128K bytes in less than 11 seconds when used with a parallel interface. The system provides ROM emulation of most types of EPROMs in use today, from 64,000 bits to 1 Mb.



The Color Pix.L monitor includes a self-compensating 85- to 264-V power supply, making it compatible with any voltage input in the world.

Price: ROM-IT with 256,000-bit emulation, \$395; with 512,000-bit emulation, \$415; with 1-Mb emulation, \$455. Additional 256,000-bit RAM, \$135; 512,000-bit RAM, \$155; 1-Mb RAM, \$195.

Contact: Incredible Technologies, Inc., 709 West Algonquin Rd., Arlington Heights, IL 60005, (708) 437-2433.

Inquiry 1018.

Give Your Atari Workstation Performance

The Atari Color Isac is a graphics board for the Atari ST that touts a 1024- by 768-pixel display resolution with 16 colors from an extended palette of 4096. (The standard Atari palette is 512

colors with 320- by 200-pixel resolution in a 16-color mode.)

The Image Systems Atari card is fully compatible with the Atari blitter (a graphics accelerator) and supports GEM programs like Page Stream and Calmus Publishing. A socket for a 68881 coprocessor lets you speed graphics processing.

The Isac works with auto-synchronous monitors that often boast 48 kHz for enhanced display resolution. It also works with multisync monitors with resolutions as high as 50 kHz horizontal.

Price: \$800.

Contact: Image Systems Corp., 11543 K-Tel Dr., Hopkins, MN 55343, (612) 935-1171.

Inquiry 1017.

Contact Management for Under \$100

A contact management program called Sales Machine includes a built-in word processor, up to 30 definable fields in its database, and the ability to automatically print daily follow-up correspondence and automatically construct daily call lists.

According to Advanced Marketing Concepts, these automatic functions differ from the tickler capabilities of the program. The program tracks where each prospect and customer is in his or her individual sales cycle and which ones are due for correspondence or calls on a given day. You can create up to 99 different marketing tracks for different types of customers.

Price: \$99.

Contact: Advanced Marketing Concepts, Inc., 515 Ogden Ave., Downers Grove, IL 60515, (800) 888-5340 or (708) 969-4400.

Inquiry 1019.

Automate Batch-File Menu Creation

The Batch'in utility from Leber Enterprises combines an expert system and a screen painter to automate the process of making batch-file menus. By answering a set of files, you can create a menu screen file that's compatible with the ANSI.SYS screen driver and MS-DOS-compatible batch files.

The batch-file writer supports up to 10 environmental variables and 10 program parameters per batch file, and it automatically cleans up after itself by removing environmentals and restoring changes to the path after the program executes, Leber

reports. The program also provides for calling a batch file from another batch file.

Leber says that the menus are ideal for a network environment and other situations where secondary shells are undesirable. The number of submenus and separate menu systems is limited only by disk space.

Batch'in runs on the IBM PC and requires 512K bytes of RAM.

Price: \$40.

Contact: Leber Enterprises, P.O. Box 9149, Peoria, IL 61614, (309) 693-0634.

Inquiry 1016.

1975-1990

15 YEARS OF BITS, BYTES, AND OTHER GREAT MOMENTS

*Witness to the birth of the microcomputer, its infancy, childhood,
and adolescence, BYTE continues to press forward on behalf of its readers*

Gene Smarte and Andrew Reinhardt

The founders of BYTE were clever enough—or lucky enough—to start their new magazine the same year the microcomputer revolution ignited. Since 1975, BYTE's history has paralleled that of the industry, reflecting its booms and busts, its hype and hubris, and, above all, its intoxicating energy.

Before 1975, the drumbeats of change in the computer world were heard but not understood. Intel had introduced the first microprocessor, the 4004, in 1971, followed in 1972 by the 8-bit 8008 and in 1973 by the 8080. Nolan Bushnell of Atari revolutionized arcade games and later home entertainment with the Pong game in 1972, and that same year a group of Californians dedicated to demystifying computers formed the People's Computer Company. In 1973, Scelbi Computer Consulting created what was arguably the first microcomputer, the 8008-based Scelbi 8-H.

But it was in 1975 that things really took off. MITS introduced the Altair 8800, computer clubs started springing up all over the U.S., and three chips that would dominate the early years of the industry—the Zilog Z80, the MOS Technology 6502, and the Motorola 6800—were all introduced. By 1976, dozens of companies had joined the fray, the first microcomputer conferences were held, and the Apple II was just around the corner.

In the following pages, we replay the story of the microcomputer industry, with a history of BYTE woven in. Compressing 15 years into 30 pages sharpens our hindsight; some products that made hardly a ripple at their introduction have gone on to become giants, while other stars have sunk out of sight. Most of all, it's sobering to realize that despite the fantastic rate of growth and change in the computer industry, we are still dealing with many of the very same problems today that we faced five and even 10 years ago.

To provide a little perspective, we've also tossed in real-world events. As a reminder of how young this industry is, recall that the IBM PC hadn't even been announced when Ronald Reagan was inaugurated and that the Macintosh was introduced the same year that Michael Jackson topped the charts with *Thriller*. Perhaps we have all, at times, gotten caught up in compiler speeds or register definitions and lost sight of the big picture.

In its early days, the microcomputer industry careened recklessly forward, often heedless of issues in the wider world. But now, computers increasingly shape the direction of our world, and as their role grows in importance, we must address important questions about their social, political, economic, health, and environmental impact. Follow our journey through history and you will see once again just how quickly the microcomputer has developed from a curiosity into a necessity.

Gene Smarte is BYTE's senior editor for special projects. He can be reached on BIX as "gsmarte." Andrew Reinhardt is an associate news editor for BYTE. He can be reached on BIX as "areinhardt."

RESEARCH: AMANDA WATERFIELD
AND JEFF BERTOLUCCI

TIME LINE INDUSTRY PHOTOS,
1984-1990: PAUL AVIS

First microcomputer conference: David Bunnell of MITS organizes the World Altair Computer Convention at the Airport Marina Hotel in Albuquerque, New Mexico; 700 enthusiasts attend. Among the products introduced: the **Cromemco TV Dazzler**, the first microcomputer color graphics board.

Texas Instruments announces the **TMS9000**, the first 16-bit microprocessor.

Apple Computer is formed.

Steve Jobs and Steve Wozniak show the **Apple I** computer to the Homebrew Computer Club.

The first computer trade show of national scope: the Personal Computing Festival held in the Shelbourne Hotel in Atlantic City; Jobs demos the Apple, and the S-100 bus used in the Altair and IMSAI acquires its name.

Steve Wozniak proposes to Hewlett-Packard that it create a personal computer. Steve Jobs proposes the same to Atari. Both are rejected.

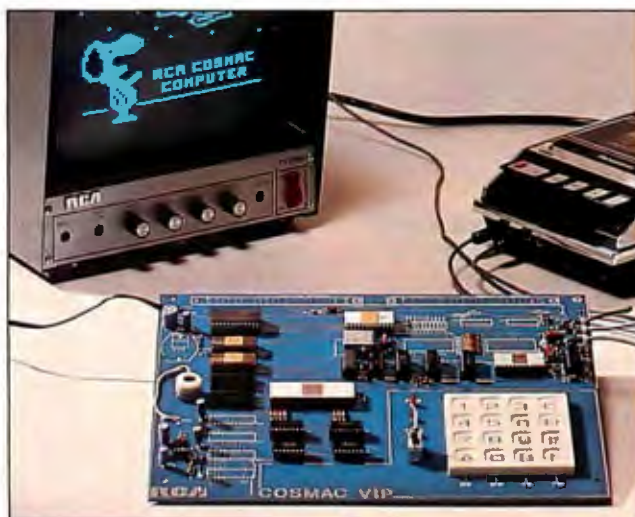
PolyMorphic Systems advertises the **Poly 88**, an 8080 machine based on the S-100 bus with 512 bytes of RAM, interfaces for video, keyboard, and cassette, and 1K bytes of ROM for \$685 in kit form.

Michael Shroyer writes **Electric Pencil**, the first word processor for microcomputers.

Crowther and Wood develop the first **Adventure** game for microcomputers.

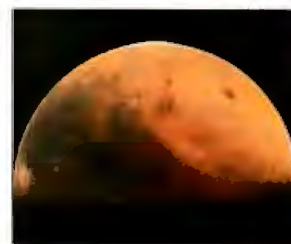
Cromemco introduces **Z-1**, the first Z80-based system, with 8K bytes of RAM and serial I/O for \$2495.

At the urging of *Creative Computing* editor David Ahl, the NCC show for the first time devotes a day of conference sessions to microcomputers.



△ RCA introduces the 1802 microprocessor. It is later used in the RCA COSMAC VIP system, which was developed by Joseph Weisbecker from a design he pioneered five years before called FRED. The COSMAC included 2K bytes of RAM, 512 bytes of ROM, a hexadecimal keypad, and interfaces for video, cassette, and audio. RCA later exited the computer business.

◁ Shugart announces its 5¼-inch "minifloppy" disk drive for \$390.



Viking I (July 20) and Viking II (Sept. 3) land on Mars and send back striking photographs of a barren, rocky landscape.

Chao-En Lai dies in China at 78.

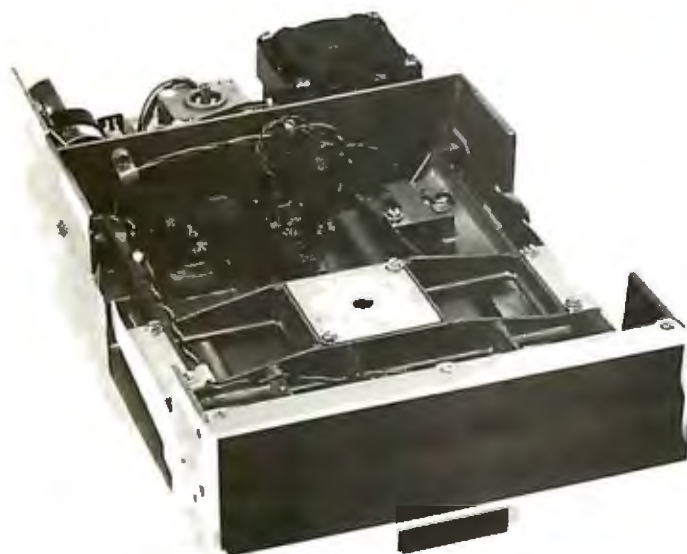
Mao Tse-tung, the father of the Chinese revolution, dies at 82.

Israeli commandos rescue 104 hostages held captive at the Entebbe airport by Ugandan dictator Idi Amin.

The King Tut exhibit, first of the blockbuster art shows, opens in Washington, D.C.



Summer Olympics in Montreal: 14-year old Romanian pixie Nadia Comaneci wins five perfect 10s in gymnastics.



1978

COMPUTER INDUSTRY

BYTE

JANUARY-APRIL

The first "year of the LAN" may have appeared with "Personal Computers in a Communications Network." Robotics-related articles continued to appear. Microcomputer training begins to get serious with "A College Microcomputer Facility." The long-lived TRS-80 gets a review.

JUNE-JULY

Real-world applications continue to emerge: "A Theatrical Lighting Graphics Package" and "Audio Processing with a Microprocessor." Also, the fixed disk drive, an expensive glint in users' eyes, is described in "A Look at Shugart's New Fixed Disk Drive." And computer industry retrospection is nothing new: "A Short History of Computing" and "The First Ten Years of Amateur Computing" appeared in July.

AUGUST-DECEMBER

In August we focused on Pascal, the start of a long-lived tradition of BYTE's annual August language issue. Computerized chess programs proliferated. The "Hobbyist Computerized Bulletin Board" could only hint at what we have today. "FORTRAN and Its Generalizations" combined with Pascal, C, and BASIC, to develop a rich set of languages for the "hobbyist."

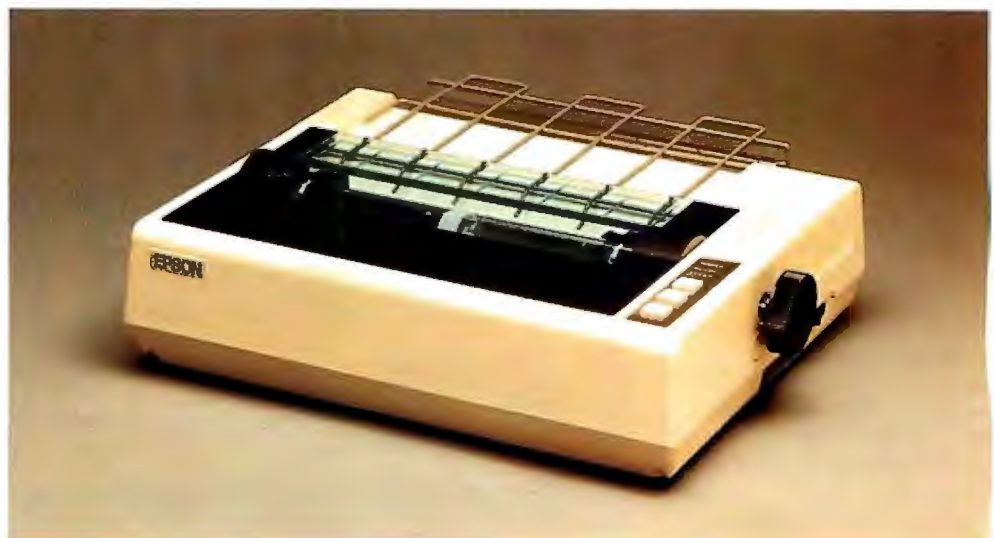


The Atari 400 (bottom) and 800 (top) were both based on the 6502. The 800, which cost \$1000, had a full keyboard, 8K bytes of RAM (expandable to 48K), two ROM cartridge slots, and custom sound and graphics chips designed by Jay Miner (who later designed the Amiga's custom chips). The 400 had an unfortunate membrane keyboard. Neither machine shipped until late 1979.



The Digital Group announces the Bytemaster, a sewing-machine-size computer housing a display, keyboard, and disk drive. Never very popular, it pre-dates the Osborne 1.

Epson America introduces the MX-80 dot-matrix printer and revolutionizes the low-cost printer market.



WORLD

Warner Amex, Atari, and CompuServe announce cable TV information service.

Steve Wozniak crashes his private plane but survives to return as an incognito grad student at Berkeley. He sponsors the money-losing US Festivals.

Tracy Kidder's *The Soul of a New Machine*, a chronicle of the development of a Data General minicomputer, becomes a national bestseller.



Timex contracts with Clive Sinclair to market the **Timex/Sinclair 1000**, the first under-\$100 computer in the U.S.

Atari and Mattel **Intellivision** video games are huge hits in an otherwise disappointing Christmas season for computer makers.

Corvus introduces **OmniNet**, an inexpensive twisted-pair LAN.



First launch of the space shuttle, the Columbia.

Assassination attempt on Pope John Paul II in St. Peter's Square, Rome, by escaped Turkish criminal Mehmet Ali Agca.

The as-yet-unidentified AIDS epidemic is first reported in the Center for Disease Control's Morbidity and Mortality Weekly Report.

Francois Mitterand becomes the first socialist president of France.

Anwar Sadat is murdered by Moslem extremists.

Martial law imposed in Poland by ruling Communist leaders.



Sandra Day O'Connor is confirmed as the first female Supreme Court Justice in U.S. history.

Hayes introduces the Smartmodem 300, which becomes the industry standard.



Epson America shows the **HX-20**, perhaps the first laptop computer; the machine weighs less than 3 pounds and uses a CMOS version of the 6801, 16K bytes of RAM, and a 20-character by 4-line display.



Iranian hostages released minutes after Reagan inaugurated.

Assassination attempt on Ronald Reagan; the would-be killer is a loner fixated on actress Jodie Foster.



Charles and Di tie the knot.

Novell introduces **NetWare**, the first file server LAN operating system.

Micro Edsels: Atari announces the **1200XL**, and Mattel announces the **Aquarius**.

IBM introduces the **XT**, which adds a 10-MB hard disk drive and three more slots to the original PC design, for \$4995.

PC Magazine sold to new owners; most of staff quits to form *PC World*.

Microsoft announces **Word** (originally called Multi-Tool Word).

Microsoft and a group of Japanese companies announce the **MSX** standard for Z80-based computers.

Osborne files for Chapter 11 bankruptcy.

IBM announces the PCjr, which is arguably the company's biggest failure of the 1980s despite reengineering and huge marketing.



AST introduces the hugely successful **SixPakPlus**, a PC add-in combining memory expansion; serial, parallel, and game ports; clock/calendar; and utility software.

Shugart shows a 1-gigabyte **WORM** drive for \$7600.

Borland International announces **Turbo Pascal** for CP/M and 8088 machines.

Ovation Technologies announces **Ovation**, perhaps the most hyped-up product to that point, and it never ships; the term *vaporware* is coined to describe it.

Compaq goes public, and 6 million shares are sold in one day.

Canon displays a 300-dpi laser printer engine for OEMs that costs less than \$2000; it shows up the next year in the HP LaserJet.

Microrim, founded by Wayne Erickson in November 1981, introduces **R:Base 4000**, the first relational database for PCs.

Microsoft announces **Windows**, but it doesn't ship for two years.

The Semiconductor Industry Association reports a book-to-bill ratio of 1.6, the highest ever recorded.

AT&T announces **Unix System V**.

Iomega introduces the first **Bernoulli Box**, an innovative removable disk drive.

◁ **The Hewlett-Packard HP 150 was an 8088-based machine that offered a unique touchscreen.**



Sally Ride becomes the first U.S. woman in space aboard the shuttle Challenger.

Faked Hitler diaries capture the news.

Dr. Luc Montagnier of the Pasteur Institute in Paris discovers the virus that causes AIDS.

Philippine opposition leader Benigno Aquino fatally shot while disembarking at Manila Airport.

Soviets shoot down Korean Air 007, killing 269 people.

Lech Walesa wins Nobel Peace Prize.

U.S. Marine barracks in Beirut are blown up by suicide-bomb terrorist; 241 lives are lost.



With Lotus's **Symphony**, the era of integrated packages gets under way; the next month, Ashton-Tate introduces **Framework**.

Visionary Alan Kay leaves Atari to join Apple.

AT&T tries to muscle into the game with its first DOS machines, but the **PC 6300** is greeted mostly with yawns.

Motorola introduces the **68020**.

Former Commodore president Jack Tramiel buys Atari from Warner Communications.

IBM also announces **Top-View**, a multitasking windowing environment for DOS programs that never catches on.

Innovative Software (later Informix) introduces **Smart Software**.

Commodore Business Machines buys Amiga Corp.

Computer Associates buys Sorcim, the maker of **SuperCalc**.

Visicorp sells much-touted but never-delivered **VisiOn** package to Control Data Corp.

Visicorp merges via stock swap with Paladin Software.

George Tate, cofounder of Ashton-Tate, dies. There was no Ashton; Tate's partner was named Lashlee.

Lotus announces **Jazz**, which went on to become the company's first flop.

Exactly one year after reaching its historic peak, the SIA's book-to-bill ratio reaches its lowest point ever: 0.64.



△ Apple unveils the Macintosh for \$2495.

▽ Apple introduces the Apple IIc.

IBM introduces the AT, with a 286, 256K bytes of RAM, a 16-bit bus, and a new high-density floppy disk drive for \$5469.



Geraldine Ferraro becomes the first woman on a major party ticket, but she can't save Mondale; Reagan is reelected in a landslide.

Indian Prime Minister Indira Gandhi is assassinated by Sikh extremists.

U.S. Census Bureau reports that 15 million Americans own home computers but only 53 percent use them.

Soviets pass up the summer Olympics in L.A.

Deadly gas leak at Union Carbide plant in Bhopal, India, kills 2500—the worst industrial accident in history.



Bishop Desmond Tutu of South Africa is awarded the Nobel Peace Prize.

1985

COMPUTER INDUSTRY

BYTE

THE SMALL SYSTEMS JOURNAL

JANUARY-APRIL

The Mac begins to make inroads into our readership, as evidenced by the number of Mac-related articles. February's Theme was Computing and the Sciences. In March, Jerry Pournelle reported on Hackercon, a first-of-its-kind convention. AI gets plenty of ink in April, with top names in the field speaking their minds.

MAY-AUGUST

Smalltalk gets a mini-treatment in May, emphasizing the growing interest in object-oriented programming. "Inside AppleTalk" hinted at the future of Apple-related networking. BIX is announced. Computers and Space is the July Theme. "The Amiga Personal Computer" is covered in August, as are the declarative languages.

SEPTEMBER-OCTOBER

BYTE's 10th anniversary issue is published in September! October's "Simulating Society" Theme presented the idea of modeling and predicting using personal computers. BYTE's second IBM Special Issue hits the streets, reflecting the growing influence on the industry.

NOVEMBER

"Five C Compilers for the Macintosh" indicated that the Mac was gaining ground. Years earlier, only MS-DOS machines would have had multiple compilers to choose from. And "CD-ROMs and Their Kin" reinforced the coming optical revolution.

DECEMBER

A "Computer Conferencing" Theme indicated that BYTE readers and the technology were ready to link up via BIX, BBSes, and other on-line electronic services.



Atari announces the Atari 520ST at CES. ▷

Tandy announces the Model 200 laptop. ▽



▷ AT&T announces the Unix PC, a 68010-based, \$5600 machine that failed to establish Unix as a PC standard.

Commodore's Amiga 1000 features a multitasking, windowing operating system and sells for \$1295. ▽



▷ General Computer HyperDrive, a hard disk retrofitted into the Mac, becomes available; it's a short-lived market niche.



WORLD

Coleco gives up on the Adam and writes down the loss.

One year after the Mac, Apple unveils the **Macintosh Office**, which includes AppleTalk and the LaserWriter, and renames the doomed Lisa the Mac XL.

DEC admits it has stopped making the **Rainbow**, and then announces a new and equally unsuccessful version.

IBM, Toshiba, NEC, Fujitsu, Hitachi, and Mitsubishi all report 1-MB DRAM chips at the annual ISSCC.

IBM says it will drop the **PCjr** in April.

Apple discontinues the Lisa.

Digital Research ships **GEM** to end users; the interface was eventually used by the Atari ST and Ventura Publisher.

Microsoft releases **C 3.0**, its first homegrown C.

Dayna Communications announces **MacCharlie**, which lets a Mac run IBM PC software; many readers think it is an April Fools' joke. ▽

Intel sues NEC over **V20** and **V30**.

Microsoft announces **Excel** for the Mac.

Lotus finally ships Jazz.

Lotus and Intel announce an expanded memory specification that will eventually become **LIM/EMS 3.2**, and Intel announces **Above-Board**.

Lotus acquires Software Arts; stops shipment of VisiCalc.

Aldus introduces the original **PageMaker** for the 512K-byte Mac.

Quarterdeck Office Systems releases the **Desqview** windowing program multitasker.

Steven Jobs resigns from Apple.

Ansa introduces **Paradox**, later to be bought by Borland.

IBM introduces its **Token Ring** network.

Intel announces the **386**.

Microsoft finally ships Windows 1.0.



△
Toshiba introduces the fantastically successful T1100 laptop.



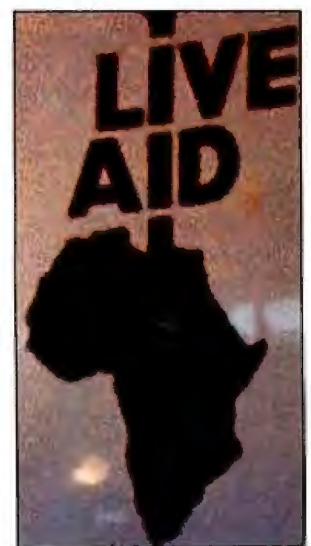
Gorbachev comes to power in the U.S.S.R.

Reagan and Gorbachev hold first superpower summit in six years, in Geneva.

Nevado del Ruiz volcano erupts in Columbia, killing 22,940.

South Africa imposes state of emergency, including press censorship.

Mexico City earthquake, 8.1 on the Richter scale, kills at least 4200.



Ethiopian famine kills millions, spurs worldwide relief effort, including "Live Aid" concert in Philadelphia and London.

1986

COMPUTER INDUSTRY

BYTE

THE SMALL SYSTEMS JOURNAL

JANUARY-MARCH

The Atari 520ST was the focus of a Product Description in January, and the 1040ST was previewed in March. It's interesting to note that despite the Atari's and Amiga's potential, the general-use personal computer industry remained mostly divided between the MS-DOS and (growing) Macintosh camps. February's "Text Processing" Theme hinted at the future popularity of desktop publishing. In March, "Homebound Computing" reflected a growing interest in telecomputing.

JUNE-JULY

We look at the Macintosh Plus in a Product Description and conclude that this is the machine that Apple should have made much earlier. And the Theme is (brass fanfare) "Computers and Music." The growing acceptance of—and even demand for—MIDI-linked music equipment begins to change foundations of musical creativity. In July, the "Engineer's Toolbox" Theme reflects the increasing use of personal computer assistance in the engineering disciplines.

AUGUST-DECEMBER

The traditional August "language" Theme is "Object-Oriented Languages," and their potential continues to be explored today. September's "68000 Machines" Theme showed that the Intel microprocessors were not everyone's choice. We previewed the Apple IIGS in October and the Compaq Deskpro 386 in November. The proliferation of PC products and peripherals led to the BYTE "23 Modems" group review process, the forerunner of today's Product Focus.



◁ The Apple IIGS is introduced on September 15.



◁ IBM introduces the RT PC, its first and not very successful venture into RISC-based desktop workstations.

IBM introduces the PC Convertible, a 12- to 16-pound battery-powered laptop for \$2000, which becomes its second unsuccessful portable.



WORLD

Paul Allen, the cofounder of Microsoft, talks about his new company, Asymetrix, and its product plans. **Tool-Book** will show up nearly 3½ years later.

Traveling Software introduces **LapLink** file transfer software for \$130.

IBM announces 4-MB DRAM chips.

Lotus files a look-and-feel lawsuit against Paperback Software and Mosaic Software, charging they have unfairly copied 1-2-3.

The Sematech consortium of chip makers is announced in Washington, D.C.

IBM announces Systems Application Architecture.

Atari and Commodore settle outstanding litigation.

Lotus signs 10-year agreement to develop software for IBM mainframes, starting with 1-2-3/M.

Lotus announces 1-2-3 release 3.0.

Microsoft and 3Com announce intention to develop OS/2 Lan Manager.

Borland acquires Ansa Software and gets Paradox.

IBM introduces the PC Convertible Model 3.

IBM introduces the PS/2 Model 25.

Apple introduces **HyperCard**, which proves to be enormously popular.

To merge the expanded memory specifications of LIM/EMS 3.2 and AST, the companies join to announce EMS 4.0.

Compaq announces it won't sell a clone of the PS/2s, although it has designed such a system.

Microsoft announces **Excel** for the PC, the first real Windows application.

Lotus announces **Agenda**, the product that brings vim to PIMs.

AT&T and Sun agree to share Unix technology.

IBM hooks up with Steve Chen, formerly of Cray, and announces plan to produce a 64-CPU parallel system in the early 1990s.

Borland introduces **Quattro**.



EXPENSE REPORT FOR ALLISON SPRING
WEEK ENDING JUNE 27, 1987

DAY OF WEEK	DATE	LOCATION	TRANSPORT	HOTEL	ENTERTAIN	MEALS
SUNDAY	06/21/87	SAN DIEGO	\$89.00	\$0.00	\$10.00	\$36.95
MONDAY	06/22/87	SAN DIEGO	\$9.00	\$7.00	\$32.50	\$19.56
TUESDAY	06/23/87	SAN DIEGO	\$27.55	\$7.00	\$0.00	\$35.00
WEDNESDAY	06/24/87	SAN DIEGO	\$12.50	\$7.00	\$98.10	\$45.15
THURSDAY	06/25/87	SAN DIEGO	\$0.00	\$7.00	\$0.00	\$24.25
FRIDAY	06/26/87	SAN DIEGO	\$0.00	\$7.00	\$0.00	\$28.55
SATURDAY	06/27/87	SAN JOSE	\$133.00	\$7.00	\$0.00	\$0.00
TOTAL			\$271.05	\$402.00	\$140.60	\$189.46

17-Mar-88 04:05 PM IBM READ

Commodore announces the Amiga 2000 and 500.



Reagan and Gorbachev sign the INF nuclear-reduction treaty.

Canada's Meech Lake Accord is passed, but it fails to win approval within three years.

Palestine Intifada breaks out in Israel.



Wall Street crash wipes 508 points off the Dow.

A VGA Laptop with Detachable Keyboard

The 80-key keyboard of Diode Export's DEX-CP286 laptop is detachable and has 12 function keys and a coil cable. You can also use the keyboard connector to connect other IBM PS/2-compatible keyboards.

The laptop is powered by a 12-MHz 80C286 microprocessor. It comes with 1 MB of DRAM (expandable to 4 MB), a 3½-inch 1.44-MB floppy disk drive, a 20- or 40-MB hard disk drive, one parallel port, two serial ports, an RGB connector for an external VGA monitor, and a bus connector for an expansion box. The DEX-CP286 also has an internal slot for a 2400-bps mini-modem card. The machine runs under DOS 3.3, which is available separately.

The double-supertwist display is backlit and has a resolution of 640 by 480 pixels. The laptop's built-in rechargeable battery pack lets you use it for 3 hours of continuous operation. An AC adapter is also included, which you can use as a battery charger.

Options available for the DEX-CP286 include a carrying bag, expansion box, modem card, and numeric keyboard.

Price: US\$2995 for the 20-MB hard disk drive model; US\$3255 for the 40-MB hard disk drive model.

Contact: Diode Export, Wilgenkade 10, 3992 LL Houten, The Netherlands, 31-3403-91390; fax 31-3403-91372.

Circle 1320 on Inquiry Card.



Diode Export's DEX-CP286 laptop has an 80-key detachable keyboard with 12 function keys and a coil cable.

Accessories for Atari Portfolio

A basic Atari Portfolio comes with 128K bytes of memory, expandable to 640K bytes by connecting extension units to the system

bus. Instead of disks, the Portfolio is equipped with memory cards secured by battery with a capacity limit of 128K bytes. The system has no expansion capability for an external floppy disk drive.

Becker & Partner offers



Becker & Partner's internal memory extensions for the Atari Portfolio are available in steps of 128K bytes up to 640K bytes.

a new accessory line for the Atari Portfolio, including an internal extension of the working memory in steps of 128K bytes up to a limit of 640K bytes and an interface Trans-Drive Portfolio. The interface connects the Portfolio to a compatible PC and allows the pocket computer to use the floppy disk drive and RAM disk of the desktop machine as its own drive.

Price: 698 to 1348 deutsche marks for the Atari Portfolio, depending on the amount of memory; DM 198 for the Trans-Drive Portfolio; DM 158 to 998 for memory modules, depending on the amount of memory.

Contact: Becker & Partner Mobile Datensysteme, Postfach 190, Wilhelmstr. 91, Viktoriastr. 51, 5100 Aachen, Germany, 49-241-509018; fax 49-241-509577.

Circle 1321 on Inquiry Card.

Debug Your OS/2 Programs

The OS/2 User Group offers RemDeb, a remote debugger for OS/2 that you can use to debug Presentation Manager (PM) programs as well as full-screen OS/2 programs. RemDeb lets you debug keystroke processing, window repainting, and VIO popups.

You can hot-key to the session manager without locking up the machine, see the debugger screen and program screen simultaneously, and add printf trace statements to programs during the debug phase. RemDeb also lets you use a PM debugger to debug PM programs, and you can run RemDeb in a PM window.

Price: £95.

Contact: OS/2 User Group, Cecily Hill Castle, Cirencester, Gloucestershire GL7 2EF, U.K., 44-285-655888; fax 44-285-640181.

Circle 1322 on Inquiry Card.

Do the Right Thing with This Hot Box

Atari's Hotz MIDI Translator, or Hotz Box, features a radically different keyboard layout that helps musicians orchestrate, rather than simply play, music. When used with an Atari computer, the Hotz Box lets you compose, edit, sequence, and perform creative projects.

When you link several Hotz systems, one unit can serve as a conductor in a jam session. When the Hotz Box is used with MIDI sound modules, one person could play bass, another piano, and another trumpet, yet everyone plays in key. With one button, the person running the master unit can configure each unit to pro-



The Atari Hotz MIDI translator, although resembling a keyboard, is completely programmable and doesn't have any moving parts. The pads are touch-sensitive.

duce notes in the same key. This way, musicians in a jam session can play without fear of hitting the wrong

note. This lets you focus on creating rather than playing, Atari says. You can program the system to play chords or notes in any key or combination of keys.

The system helps musicians by expanding their musical vocabularies. You can program the system to play complicated chord combinations—not just major and minor chords—and scales flawlessly, Atari says.

The MIDI-compatible system comes with extensive libraries of chords and scales. When used with MIDI sound modules, it can reproduce the sound of any instrument.

Price: \$5500.
Contact: Atari Computer, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088, (408) 745-2000; fax (408) 745-2088.

Circle 1026 on Inquiry Card.

A MIDI Maestro for the PC

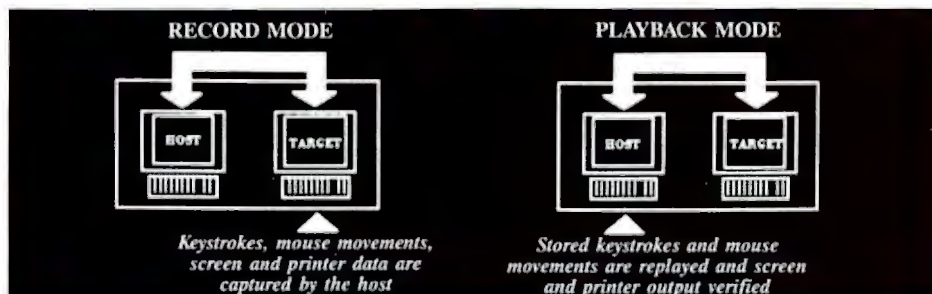
The Covox MIDI Maestro consists of a card that fits into a slot on your PC, a score print program, and a 64-track MIDI sequencer that samples at a rate of 600 beats per quarter note. Covox says the sampling rate lets you record even a snare drum roll and play it back without it sounding choppy.

The sequencer uses a routine that adds the human factor back to quantized music. This lets your music sound tight, not computerized.

Price: \$189.95.
Contact: Covox, Inc., 675 Conger St., Eugene, OR 97402, (503) 342-1271; fax (503) 342-1283.

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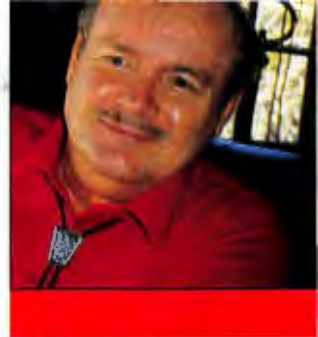
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JERRY
POURNELLE

ATARI REVISITED

Well, it's done: Larry Niven and I finished *Fallen Angels* yesterday. It's scheduled for June publication from Baen Books, which means you ought to find it in bookstores in late May.

Tomorrow I catch a plane for Washington, D.C., where the American Association for the Advancement of Science is meeting this year. AAAS is my hands-down favorite conference of the year, even better than the World Science Fiction Convention. Writing takes a lot of output; AAAS is where I get input. This year, I'm also paying my dues by giving a talk on uses of small computers in science, as well as a lecture at George Washington University on technology and society.

Meanwhile, I'm recovering from minor but painful surgery: they had to slice a small skin cancer out of my face. The result is a Heidelberg scar and the world's worst black eye; it's the black eye that's relevant here. Because of it, I wasn't able to get some of the research done that I'd intended for this column. So it goes. As usual, there's still plenty to write about.

Atari TT030

The newest computer at Chaos Manor is the Atari TT030, which, as the name implies, is powered by the Motorola 68030 chip and is a sort of super Atari ST. The 68030 runs at 32 MHz, in tandem with a 68882 floating-point math coprocessor and built-in cache memory. It certainly runs all the old Atari ST software I could find, including stuff written by my Russian friends at ParaGraph. I now have *Perestroika*, the Game, running on the TT030, and considering how graphics-intensive the game is, that's no bad test. It runs quite smoothly, if too fast.

The TT030 is what the Mega 4 should have been: the case is sensibly designed, although still plastic; the detached keyboard looks professional, with normal function keys instead of the cutie-pie slanted function keys on the 1050ST; and, in general, the machine has a solid, professional look and feel.

Like all Atari machines, it has about a zillion ports, including game, mouse, serial, parallel, and a cartridge port into which you can plug your Spectre Cartridge from Gadgets by Small and have the equivalent of a fast Mac. For reasons not clear to me, the keyboard cable connects to the right side of the keyboard but the left side of the computer.

The TT030 is one of the items I'd intended to do more with until my plans were drastically altered by

surgery; alas, I've had little time to work with it.

My first impressions are quite favorable. Getting the machine running was no problem: I took it out of the box and set it on a stand. I looked in the manual and found that the machine was said to work with VGA color monitors, particularly multisync, so I connected it to the Tatung 14-inch monitor that came with the Gateway 2000 computer—the TT030 has a 15-pin VGA connector that the Tatung (or almost any VGA monitor) will plug into—and turned it on. The monitor flashed white. Then nothing happened for a long time—so long that I believed something was broken. I turned off the machine, checked the connections, and tried again. Still nothing.

I figured I had done something wrong, so I unpacked the TTM195 monitor that came with the TT030, an enormous TTM195 VGA monochrome gray-scale 19-inch monitor, and connected it up. I turned on the system. The monitor flashed a couple of times and then settled down to a uniform white. Then nothing happened. I retrieved the box the TT030 had come in from the storage shed, since I figured I'd have to be sending the machine back. Then I had to look for the manual. When I came back, the operating system (TOS) was running and GEM was on the screen, looking nicer than I'd ever seen it, and there was no question the system was working.

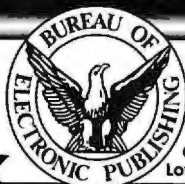
One of the programs on the TT030's hard disk was Mandelbrot, so I clicked on that; the result in monochrome was interesting but not very pretty, so I decided to give the Tatung monitor another try. I plugged that into the system and reset, and, lo, up it came; it just takes a while.

In fact, the TT030 doesn't take all that much longer

Jerry takes a first look at the new Atari TT030, seeks a GUI word processor, and discourses on typefaces



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than a big 486 to power up and do memory tests; the difference is that the Atari TOS shows you *nothing* on the screen until it's ready to go to work, while DOS systems tell you what they're doing on power-up. Also, the TT030 seems to take a lot longer to power up when it's cold than it does when it has been running a while. None of this is any big problem, and once it has been powered up, hitting the hardware reset button gets an instant reboot that takes no more than a few seconds.

The Mandelbrot program runs interestingly, with repeated iterations that smooth out the jagged lines as you watch. It's a good demonstration of the TT030's VGA resolution.

So far, I haven't found any of my older ST software that doesn't work on the TT030, although I do have to change the monitor's resolution. The TT030 has all the ST resolutions plus its own higher screen resolutions: 320 by 480 pixels with 256 colors or 640 by 480 pixels with 16 colors, both from a palette of 4096 colors. The monochrome mode is no slouch either, with 1280 by 960 pixels on the TTM195 monitor. When you change resolutions, the TT030 automatically does the equivalent of a reboot.

I am told, though, that there are some compatibility problems with older ST software. This is particularly true with games and other software that have timing loops, since the 68030 is much faster.

I no longer have a lot of Atari software other than games. Alas, I seem to have mislaid my copies of Sundog and Dungeon Master—doubtless they were put in a "safe place," which means they may not surface for years—but it's not fair to restrict the TT030 to games. This is a solid machine, with a GEM interface and a better keyboard than I started with in this business. I have a copy of Aladdin ST, which is the front-end program for GE's GENIE information service, and that works just fine. So does WordPerfect and a bunch of other standard business software. The TT030 is definitely a lot more than a toy.

The TT030 has a built-in MIDI port, which should interest musicians. I'm told that the Stacy Laptop, which is the portable Atari ST, has become just about the de facto standard interface for keyboard musicians.

I find that many Atari ST "power users" almost exclusively use it with the Spectre Cartridge because Mac software is so much better than Atari software. For instance, they use WriteNow, instead of any of the Atari ST word processors, and Excel as a spreadsheet. I have

not tried the TT030 with the newest versions of Dave Small's Spectre Cartridge, but people who have tell me it works fine.

A tentative conclusion: the Atari TT030 system is good enough for almost anything you'd want to do with a computer. It's close to state of the art for music support. There's a wealth of ST software developed in Europe, and quite a lot is available here as well. However, the Atari does remain outside the mainstream of U.S. computer development. It supports a lot of stuff that would otherwise be obsolete, but it neglects advances in the state of the art. You generally can use it to get the job done.

You'll probably be hearing more about the Atari TT030.

Atari PTC1424 "Colour" Monitor

I got this 14-inch monitor today. The manual tells me that it's a multisync monitor for all VGA systems, and it operates on "240 Volt 50Hz mains," as well as informing me that it's a "colour" monitor. In fact, it plugs into the 110-V outlet, but the manual shows its European origins.

It works fine with the TT030, with no discernible difference from the Tatung multisync monitor. It also works with the Premier 9000 in place of the Zenith Flat Technology Monitor, but not very well: the vertical lock is way off, and it flickers. That's all right: when I plugged the 31-kHz Zenith FTM into the TT030, the display was readable, but it flickered. Putting the Atari PTC1424 monitor with the Atari TT030 works fine. Apparently, the PTC1424 and the TT030 really were made for each other.

The TTM195 monitor works wonderfully well with the TT030, too.

Tracker/ST

When I knew I was getting the TT030, I looked for software. One of the first programs to arrive was Tracker/ST, which is a combination database, mail-label generator, and mail-merge program.

Tracker/ST is a near-perfect illustration of the pros and cons of using the Atari computer for business. The good points are that the software is cheap and easy to learn. It does the job in a no-frills, unimaginative way. You really can set up and use this for business correspondence and mailing lists. On the other hand, it is unimaginative; the user interface has the flavor of CP/M during the early days of personal computing.

Example: Tracker/ST includes support for Epson 9- and 24-pin printers, NEC 24-pin printers, Diablo-compatible

daisy-wheel printers, and the Hewlett-Packard DeskJet and DeskJet Plus. No laser printers. Of course, you *can* use the Atari SLM804 laser printer, but you must select either the Diablo emulator or the Epson LaserBrain emulator; there's no provision to use the laser printer as itself. They then add, "We feel that the LaserBrain emulator is a better choice, but it currently works only with a monochrome monitor. . . ."

As I said, shades of CP/M days. My original Diablo printer is in the Smithsonian, and while I do bring out an NEC SpinWriter once a month to write the checks, it's only because I have a SpinWriter and a vast supply of pin-feed checks. I wouldn't buy that setup today. On the other hand, there's a lot of older good-enough equipment out there on the used market, and it's nice to know there are still some systems that support it.

More on all this when I get more software and have more time.

Adventures in Musicland

Some of you may remember a wonderful movie called *The 5,000 Fingers of Dr. T.*, with Hans Conried, Mary Healey,

and Peter Lind Hayes. Alas, it wasn't a commercial success. It was later chopped mercilessly and released as *Crazy Music*, which wasn't a success, either. If you can find a videotape of the original, rent it or buy it, and watch it with your friends or a

A

dventures in Musicland is a series of musical games.

bright child, or both. Whatever your interest in music, I doubt you'll regret the experience.

Clearly Dr. T's Music Software takes its name from that film; and while it's hardly an amusement for adults (which the movie was, or so I think), Adventures in Musicland does try to retain the flavor

of having fun with music. The program is a series of musical games, which, although billed for "children of all ages," are most suitable for the younger end of the spectrum: 10 and under at a guess, although I could be off a bit. Adventures in Musicland tries to teach musical principles through repetition, games, and fun, with goofy illustrations taken from the old woodcut illustrations of *Alice in Wonderland*. You listen to tunes and try to reproduce them, turn over cards to match them, and build musical symbols—that sort of thing.

This is one I'd recommend you look at before buying: some are going to like it a lot, but some will think it's a bit elementary. The version I have is for the Mac, but there's also an Atari version.

Mac Misgivings

Every time I'm ready to conclude that the Mac is a stable and reliable machine, something happens to make me wonder. Case in point: I'd put Adventures in Musicland up on SuperMac, the big Mac IIx with the 8•24 GC video card. Adventures worked fine. I played around with it enough that I could write about it,

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the case I have described is pretty simple compared with those routinely faced by social scientists, epidemiologists, criminologists, and many others. It may be fashionable to denigrate statistics, but billions of dollars are allocated by statistical inferences.

Statistics is popularly supposed to be a dry and dull subject, and in the old days it was; but a good part of that was due to the sheer tedium of the calculations required. Systat and small computers take the sting out of that.

I can't claim that Systat will make statistical inference as exciting as *Fallen Angels*; but I suspect you would get more out of studying Systat than reading the book. (Actually, I recommend that you do both.) There are very few professions, business or science, that don't have questions that can be answered only by statistical inference.

Winding Down

Well, I'm now in Washington, finishing this up on the Zenith SupersPort SX, which remains too heavy while travel-

ing, but it's still the best machine to use when I get to where I'm going. It's time to get this on the wire.

The two books of the month are reissues: Jacques Barzun's classic *Teacher in America* and Bertrand de Jouvenel's *The Ethics of Distribution*. Both are available from Liberty Fund (7440 North Shadeland Ave., Indianapolis, IN 46250, (317) 842-0880). Liberty Fund has reprinted a number of classics in history and political science, and it's well worth getting their catalog.

The gizmo of the month is After Dark, a screen saver from Berkeley Systems. This has security stuff like optional passwords to get your screen back, but mostly it's just fun: you can put an aquarium, or flying toasters, on your PC's VGA screen. There is supposed to be a Windows version Real Soon Now.

It may be all over in the desert by the time you read this, but if you're curious about the new wizard weapons, the easiest way to learn is a \$10 64-page illustrated book called *Desert Shield Fact Book* (GDW, P.O. Box 1646, Bloom-

ton, IL 61702). I sure wish some of the reporters would read this. They might get fewer things wrong.

The computer book of the month is *Undocumented DOS: A Programmer's Guide to Reserved MS-DOS Functions and Data Structures* by Andrew Schulman, Raymond J. Michaels, Jim Kyle, Tim Paterson, David Maxey, and Ralf Brown. The book, which comes complete with two disks of software, is published by Addison-Wesley. The title says it all. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryjp."

A GEM by Any Other Name

Janet J. Barron

In 1985, Digital Research, Inc. (DRI), released a graphical user interface system software called GEM. At that time, GEM ran on top of the operating systems for the Atari ST and PC-compatible machines. Since then, Atari has continued its own development of the software, and GEM is now built into the ROMs of all Atari ST computers. The company continues to upgrade both the base operating sys-

tem and the Atari version of the GEM interface. It releases its new ROMs through retail outlets.

On the PC-compatible side, GEM has largely been superseded by Windows and OS/2. As a result, DRI is leaning away from the GEM name and original concept and choosing instead to release new applications that overlay and use some of the former GEM functionality. These include Presentation Team 2.0, a

\$495 presentation program available as a stand-alone package or as a network server version, and Artline, a graphics illustration program available only as a stand-alone package for \$595.

Currently, the only way to obtain the GEM system software by itself is to purchase the GEM programmer's toolkit. At a cost of \$500, this kit is designed for developers who want to incorporate the GEM engine into their applications.

single document. This is part of a new "document-centric" world view (as opposed to "application-centric"), in which you manipulate a document with a variety of tools, rather than "opening" an application and working with a single type of document. So far, only two Microsoft products incorporate OLE—Excel 3.0 and PowerPoint—but the company says that it expects all future releases to incorporate the technology.

Interestingly, the types of features that OLE offers have been available for some time from Hewlett-Packard's NewWave, a sort of "super-GUI" that sits on top of Windows. So far, however, the only applications that run under NewWave have come from HP. That leaves NewWave users in the same boat as the lower-end Ensemble users; thanks to preemptive multitasking, Ensemble has the capability to provide true interprocess communications. Until developers create programs to take advantage of that capability, though, it won't do you much good.

Another issue is how strong the links are between two applications. Under Windows, DDE links require one document to remember the location on the hard disk of another document. If you reorganize your hard disk, change a path name, or delete a file, the link breaks. That isn't true of NewWave, which tracks files more carefully.

On the Amiga Workbench, the ARexx macro language lets you share data between two or more Amiga programs equipped with ARexx message ports. (Such ports have lately become de rigueur on Amiga applications.) ARexx lets you create "meta-applications" using stand-alone Amiga programs.

Networks and Windows

These days, more and more of our personal computers are connected to other systems via LANs. Another consideration about GUIs is, therefore, how well they work with networks. Ideally, a GUI should let you attach to a network easily and should thereafter treat network resources (e.g., hard disk drives and printers) as if they were peripherals attached to your own machine.

We have to recognize two different approaches here: X Window System and the rest of the world. The X approach is inherently network-oriented, so GUIs based on it will operate over networks more easily and efficiently.

In the non-X world, the ease or difficulty of attaching to a

network varies. Of course, you first must have the right hardware installed. The software can, however, make it easier to change networks or reconfigure the network you're attached to. The Macintosh's Chooser menu lets you select a network, enter your passwords, and go on from there. Windows 3.0 provides the same capabilities through its control panel and print manager. OS/2, on the other hand, doesn't provide those kinds of user-friendly network reconfiguration tools. (Note that the only network software currently available for OS/2 is LAN Manager.)

The Amiga Exec doesn't provide specific support for networking. Each network implementation and application must provide its own hooks into the operating system. However, Commodore is currently developing a layer for Exec called the Standard Amiga Network Architecture, which will provide a common application programming interface for networking functions. SANA will make it much easier to network Amigas.

Ensemble has no network capability at this time, although GeoWorks has indicated that it plans to support networks in the future. And although NextStep is not X-based, it is heavily dependent on networks and servers, and all Next applications have network capability built in.

Getting Help

GUIs are so easy to use that you don't need manuals or support, right? Right. But just in case, you'd better have a manual handy, and on-line help *would* be nice. It makes sense to be able to ask the interface for help, rather than having to look up what you need to know in a book.

Unfortunately, on-line help seems to be the exception, rather than the rule, for GUIs. Only OS/2 PM, Windows 3.0, and NextStep provide such help. All of them are good, fairly extensive on-line help systems. The Windows help facility is a hypertext system that includes graphics. Vendors can add help information on their own software for the system. The Next computer's help system is a separate, launchable documentation application.

Although the Macintosh doesn't currently provide on-line help, System 7.0 includes a help facility called Balloon Help. When you activate this feature, passing the cursor over any item on the screen will bring up a cartoon balloon-like graphic con-

Speed, Power, and Compatibility from Atari

Atari is offering what it calls a true 32-MHz, 32-bit computer system. Geared toward applications such as professional graphics, CAD/CAM, and desktop publishing, the TT030 is based on Motorola's 68030 microprocessor. The open-architecture system includes built-in cache memory and a 68882 enhanced floating-point math coprocessor. Its standard 2 MB of RAM is expandable to 26 MB.

Among other features, the system has a 3½-inch floppy disk drive, four serial ports, an internal A24/D16 VME card slot, and an optional hard disk drive. The three graphics modes of the TT030 are 320 by 480 pixels with 256 colors, 640 by 480 pixels with 16 colors, and 1280 by 960-pixel monochrome. The system also includes network-ready hardware and a real-time clock with non-volatile RAM.

Price: \$2399.95 to \$3499.95, depending on configuration.

Contact: Atari Computer, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088, (408) 745-2000; fax (408) 745-2088.

Circle 1271 on Inquiry Card.



The open architecture of Atari's TT030 lets you expand your system as your needs change.

Power in a Cube

Based on AMD's Am386DXL 40-MHz microprocessor, the Cube 386/40 Enhanced System provides 21 percent more power than a 33-MHz system at the same cost, according to Cube Computer. The system is available as the 4¼-inch-high Deskline or the 13-inch-high Desktop.

The Cube 386/40's 4 MB of RAM is expandable to 64 MB, and it has a 64-KB high-speed memory cache. It includes a 104-MB Conner Intelligent Drive Electronics hard disk drive, 3½- and 5¼-inch floppy disk drives, a Trinitron Super VGA non-interlaced 14-inch color monitor, a noninterlaced VGA card with 1 MB of

video RAM, an internal modem, a Microsoft Mouse, and Adobe Type Manager.

Price: \$3690.

Contact: Cube Computer Corp., 150 Clearbrook Rd., Elmsford, NY 10523, (800) 522-2823 or (914) 592-8282; fax (914) 592-3482.

Circle 1272 on Inquiry Card.

Mini 386SX Offers Something New

A fresh design and an all-new interior coupled with a programmable keyboard delineate the minidesktop 20-MHz 386SX cache computer. The Gateway 2000 machine has an integrated floppy disk/Intelligent Drive Electronics (IDE) host adapter and serial and parallel ports that you can disable through the BIOS.

Designed around a backplane and riser card with five 16-bit slots, the 386SX/20 comes with 4 MB of RAM (expandable to 16 MB), an 80-MB IDE hard disk drive (expandable to 200 MB), and a 32-KB RAM cache. It includes 3½- and 5¼-inch floppy disk drives, a VGA chip set with 512K bytes of

RAM on the motherboard, and a color monitor. The daughterboard processor snaps onto the backplane.

Price: \$1995.

Contact: Gateway 2000, 610 Gateway Dr., North Sioux City, SD 57049, (800) 523-2000 or (605) 232-2000; fax (605) 232-2023.

Circle 1273 on Inquiry Card.

Infinity in a Small Space

A 20-MHz Infinity Desktop Computer is available in five configurations from Falco. The machine increases CPU performance by 25 percent over the company's 16-MHz Infinity model.

The 20-MHz Infinity has a built-in 65-W auto-ranging power supply. With the exception of the unit's one parallel and two serial ports, peripheral interfaces are on the motherboard. The unit includes 512 KB of video RAM, 1 MB of expandable RAM, and two three-quarter-length 16-bit bus-expansion slots for LAN, fax, or other cards. A 1.44-MB floppy disk drive is standard on all but the diskless version.

Price: Diskless, \$1016; with one floppy disk drive, \$1098; with 40-MB hard disk drive, \$1635; with 100-MB hard disk drive, \$1954; with 210-MB hard disk drive, \$2404.

Contact: Falco Data Products, Inc., 440 Potrero Ave., Sunnyvale, CA 94086, (408) 745-7123; fax (408) 745-7860.

Circle 1274 on Inquiry Card.

The Cube 386/40 Enhanced System offers workstation performance at a 386 price in its Deskline model.





The 4-ppm MT904 laser printer combines a small footprint and a small price tag.

A Low-Cost 4-ppm Laser Printer

If you're looking for a laser printer that combines a small footprint and a small price tag, then Mannesmann Tally's MT904 may be for you. The 4-ppm printer, which measures just 36.5 by 40.5 cm, includes 14 Hewlett-Packard-compatible resident fonts and HP LaserJet IIP emulation.

The MT904 comes with 512 KB of memory, which is expandable with 1-MB memory upgrades up to a total of 2.5 MB. A single slot lets you add HP-compatible plug-in fonts, and the printer comes with Centronics and RS-232 interfaces.

Paper handling on the MT904 includes a 100-sheet feeder, manual feed, and a face-down output tray.

Price: £949.
Contact: Mannesmann Tally Ltd., Molly Millar's Lane, Wokingham, Berkshire RG11 2QT, U.K., 44-734-788711; fax 44-734-791491.

Circle 1282 on Inquiry Card.

A Relational Database for the Atari ST

Kuma Computers offers Adimens 3.0, a relational database for the Atari ST that provides features such as export and import of data, calculating fields, multilevel sorting, time fields, character replacement, menu prompts, and graphical controls. The package also features a merge form option; interfacing to other programs, such as K-Word 2, for mail-merge applications; system time and date handling; error checking and error messages; and an editable printer driver. Adimens 3.0 is compatible with all versions of the Atari ST operating system.

Price: £129.95.
Contact: Kuma Computers Ltd., 12 Horseshoe Park, Pangbourne, Berkshire RG8 7JW, U.K., 44-734-844335; fax 44-734-844339.

Circle 1283 on Inquiry Card.

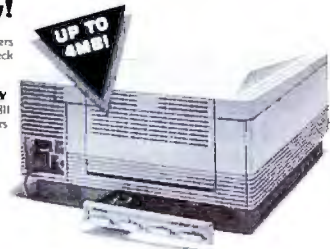


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Atari's Falcon030 Leads the Pack

While IBM, Apple, and others are expected to introduce computers with DSPs (digital signal processors) later this year, the first company to ship a low-cost PC with a DSP is none other than Atari—the video-game company that once hit \$2 billion a year in sales and then nearly collapsed in the mid-1980s.

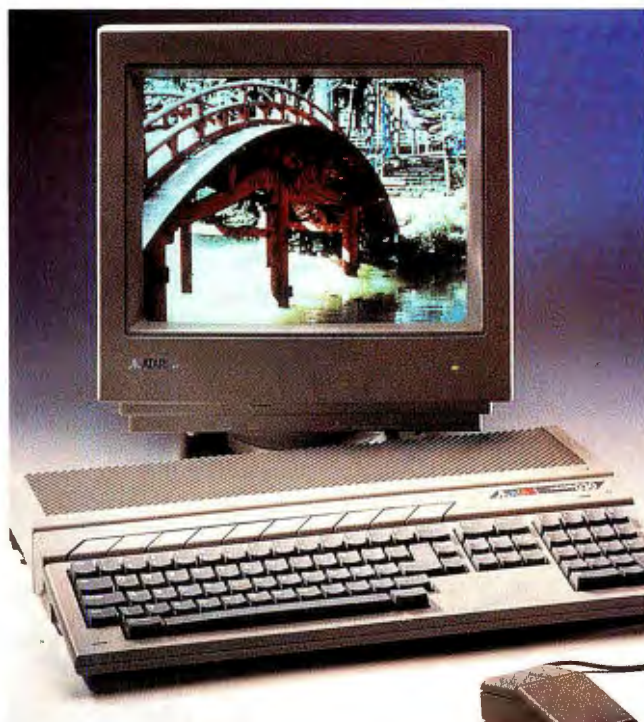
Although Atari is smaller these days, it's still selling a line of computers. Atari's latest computer, the **Falcon030**, is a surprisingly versatile machine that points the way toward a new generation of multimedia computers. Given Atari's track record, it's hard not to be skeptical, but the Falcon really is something different.

Right out of the box, with no additional hardware required, you can attach the Falcon to a VGA monitor, a TV, a VCR, a camcorder, a stereo system, a pair of microphones, an electric guitar, a MIDI keyboard, or almost any audio/video device that accepts a patch cord. To add similar capabilities to any other PC would probably cost more than the price of the Falcon—\$799 for the basic unit with 1 MB of RAM and a 1.44-MB floppy drive.

With the right software, you can mix multiple sound sources, apply special effects, and record audio on either a tape recorder or the computer's hard disk. If you choose direct-to-disk digital recording, the Falcon supports eight-track, 16-bit stereo at sampling rates of up to 50 kHz, exceeding the quality of CDs and DAT (digital audiotape).

The Falcon is also adept at handling video and graphics. Built-in video supports 65,536 colors at 640 by 480 pixels, with 262,144 possible hues. The computer accepts an external video synchronization signal for genlocking, and a special overlay mode lets you add titling and special effects. Composite video and RF outputs are standard. It wouldn't take much to turn the Falcon into a low-cost video workstation.

What makes all this possible is the 32-MHz Motorola 56001 DSP, coupled to a 16-MHz 68030 CPU and a pair of custom coprocessors. The DSP is the most important component. DSPs excel at pro-



cessing fast streams of sampled analog data in real time, making them ideal for multimedia applications. Computers with DSPs can do a better job of manipulating music and speech, compressing sound and graphics, and communicating with analog devices. What's more, DSPs can work in the background, freeing the CPU for other tasks.

For example, the Falcon's DSP supports eight 16-bit DMA channels that operate in parallel, allowing simultaneous audio recording and playback. Standard audio interfaces include stereo I/O jacks and a pair of MIDI ports for attaching music keyboards and other MIDI devices.

Another port brings out the pins of the DSP bus. This makes the DSP accessible for a wide range of uses, including video digitizers and telecommunications. Also standard are a LocalTalk port for easy networking with Macs and a SCSI-2 port with DMA. The fast SCSI port is vital because the Falcon's internal 65-MB hard drive isn't nearly large enough for serious digital recording, which at CD quality gobbles up more than 7 MB per minute. With the SCSI-2 port, you can add as much storage as you can afford.

The Falcon runs a proprietary multitasking operating system and Digital Research's GEM. It's compatible with most

software written for Atari's earlier ST computers, including a wide variety of applications for business, desktop publishing, and entertainment. There's a particular abundance of music software, and some of it's being rewritten to take advantage of the Falcon's DSP. Only a few DSP-driven programs were available for this evaluation, however, and they were still unfinished.

One program I tested was Musicom. I plugged an electric guitar into the Falcon and used Musicom to add flanging, harmonizing, equalizing, digital delay, and heavy-metal distortion—replacing hundreds of dollars' worth of special-effects pedals. Next, I digitally recorded a rhythm track onto the Falcon's hard disk. I used Musicom to play back the rhythm guitar, mix in a lead guitar, and record both parts on a tape recorder. And I did all

this without any extra hardware.

Until now, the only desktop computers with integrated DSPs were the Next workstations, which also use the 56001 DSP from Motorola. IBM and Texas Instruments have developed a DSP called the MWave, which will appear in IBM's Ultimea computers later this year. Apple has adopted AT&T's DSP3210 for its future Macs. With the Falcon030, Atari is offering a tantalizing and affordable preview of things to come.

—Tom R. Halfhill

THE FACTS

Falcon030

with 1 MB of RAM and a 1.44-MB floppy drive, \$799; with 4 MB of RAM (expandable to 14 MB) and an internal 65-MB IDE hard drive, \$1299

Atari
1196 Borregas Ave.
Sunnyvale, CA 94089
(408) 745-2000
fax: (408) 745-4306

Circle 1170 on Inquiry Card.